



Polycyclic Aromatic Hydrocarbons

Polycyclic Aromatic Hydrocarbons (PAHs) include hundreds of different chemicals that commonly occur as mixtures in the environment. Limited toxicological data are available on PAH mixtures; therefore, individual PAHs are typically evaluated as separate chemicals for risk characterization. Analyses of samples from sites where PAHs are a concern should include the carcinogenic (cPAH) and non-carcinogenic PAHs listed below.

The information contained in this fact sheet follows the Remediation Division Policy on PAHs (<http://www.pca.state.mn.us/index.php/view-document.html?gid=16052>). Based upon an evaluation of the likely sources of extended cPAHs in the environment, consistency with the U.S. Environmental Protection Agency (EPA) and other state remediation programs, current limitations of the analytical method, and Minnesota Department of Health's (MDH's) recommendation to use the extended list, the extended list of 25 cPAHs should be used to evaluate risk to human health in the specific circumstances listed below. At the vast majority of remediation sites, the short list of seven cPAHs can be used, as included in SW-846 Method 8270. The extended list and short list of cPAHs are shown in Table 1. Please note that if ecological exposure pathways in aquatic sediments are of concern, MPCA's ecological risk assessment staff should be consulted to determine appropriate analytical requirements for PAHs. To properly evaluate ecological risk to benthic invertebrates in aquatic sediments, it may be necessary to also analyze for the alkylated forms of the parent PAH compounds in sediment pore water for comparison to EPA Equilibrium-Partitioning Sediment Benchmark Values (SW 846-Modified Method 8270).

Use of the extended list of cPAHs to evaluate risk to human health is recommended in the following circumstances:

- Sites where a combustion process (e.g. incinerator, open burning) was the source of the soil contamination;
- Sites where stormwater pond sediments are being characterized for potential reuse. These sediments may contain extended list cPAHs due to the prevalence of coal-tar based products used to seal coat parking lots and other paved surfaces;
- Sites where environmental forensics or fingerprinting may be useful to identify sources or waste streams of cPAHs; and
- Sites where a formal human health risk assessment is being conducted in response to cPAHs being identified as a contaminant of concern, or sites where extended list cPAHs have been previously identified. In these situations, it is recommended that MPCA and/or MDH risk assessment staff be consulted to determine if analysis of the extended list of cPAHs is necessary.

Because current limitations to the laboratory analytical method may result in a fair number of "non-detects" when analyzing for the extended list of cPAHs, a brief mention of how to handle non-detect data when calculating the benzo(a)pyrene equivalent is warranted. The practice of substituting a fraction of the detection limit for non-detect data is no longer recommended. Recent research has shown that such a practice obscures patterns and trends in data or, equally undesired, may suggest patterns and trends where none exist. If descriptive statistics for a data set are desired (and enough data is available to justify a statistical analysis), various software packages exist which handle non-detect data in a more scientifically sound manner. Otherwise, using "zero" for non-detects in the benzo(a)pyrene equivalent calculation is recommended, provided that the laboratory achieves reasonable method detection limits. If elevated method detection limits result in non-detects that have little interpretative value, it is recommended that an MPCA Quality Assurance Coordinator (<http://www.pca.state.mn.us/wfhy20>) be consulted for assistance in evaluating the data and for guidance on improving the usability of data collected in the future.

Table 1. Short List and Extended List of PAHs

Method 8270 - Short List	Method 8270 - Extended List
7 cPAHs	25 cPAHs
Benz[a]anthracene	Benz[a]anthracene
Benzo[a]pyrene	Benzo[a]pyrene
Benzo[b]fluoranthene	Benzo[b]fluoranthene
Benzo[k]fluoranthene	Benzo[k]fluoranthene
Chrysene	Chrysene
Dibenz(a,h)anthracene	Dibenz(a,h)anthracene
Indeno[1,2,3,-c,d]pyrene	Indeno[1,2,3,-c,d]pyrene
9 non-carcinogenic PAHs	Benzo[j]fluoranthene
Acenaphthene	Dibenz[a,h]acridine
Acenaphthylene	Dibenz[a,i]acridine
Anthracene	7H-Dibenzo[c,g]carbazole
Benzo(g,h,i)perylene	Dibenzo[a,e]pyrene
Fluoranthene	Dibenzo[a,h]pyrene
Fluorene	Dibenzo[a,i]pyrene
Naphthalene	Dibenzo[a,l]pyrene
Phenanthrene	7,12 Dimethylbenzanthracene
Pyrene	1,6-Dinitropyrene
	1,8-Dinitropyrene
	3-Methylcholanthrene
	5-Methylchrysene
	5-Nitroacenaphthene
	6-Nitrochrysene
	2-Nitrofluorene
	1-Nitropyrene
	4-Nitropyrene
	9 non-carcinogenic PAHs
	Acenaphthene
	Acenaphthylene
	Anthracene
	Benzo(g,h,i)perylene
	Fluoranthene
	Fluorene
	Naphthalene
	Phenanthrene
	Pyrene