Minnesota Pollution Control Agency

Remediation Division Policy on Analysis of Carcinogenic Polynuclear Aromatic Hydrocarbons (cPAH) June 2011

Background

A Minnesota Pollution Control Agency (MPCA) memorandum dated October 2002 directed Superfund RCRA and VIC staff to begin analyzing for an extended list of 25 cPAHs at remediation sites where PAHs are present. The memorandum noted some outstanding questions regarding the possible implications of applying the extended list of cPAHs to sites in Minnesota, and whether the apparently increased conservatism of the approach had sufficient scientific support. It was decided to implement the extended list of cPAHs beginning on January 1, 2003, as recommended by the Minnesota Department of Health (MDH), with the understanding that such questions would be addressed in the future as staff resources became available, and subject to case-by-case risk-based decisions.

A work group comprised of Superfund and VIC staff was recently convened to evaluate the pros and cons of using the extended list of cPAHs in light of the experience and knowledge gained since 2003. The findings of the work group are summarized by the following bullet points:

- The primary sources for the extended cPAHs in the environment appear to be *combustion* and *coal-tar based derivatives*.
- The extended list of 25 cPAHs was developed by the California Environmental Protection Agency (EPA) for application within its Air Toxics program.
- MPCA staff contacted remediation programs in California, Wisconsin, Massachusetts, Connecticut, New Jersey, Missouri and Florida. None of these states require the extended list of cPAHs for soil or groundwater analyses.
- The U.S. EPA does not include the extended cPAHs in its Superfund soil screening guidance or its Contract Laboratory Program (CLP) Semivolatile Target Compound List (SW-846 Method 8270).
- The specific cPAHs on the extended list were chosen based on the availability of toxicological data. For some of the compounds, laboratory analytical methods are currently unable to achieve meaningful detection limits relative to the risk-based threshold levels.
- The cPAH analysis can present challenges for a laboratory. Contact the MDH Environmental Laboratory Accreditation Program for laboratories that are currently capable of performing this analysis.
- In order to meet the data quality objectives for a project, a laboratory may need to use one or more cleanup procedures. For PAH analytes, laboratories should use EPA Methods 3611 (Alumina Column Cleanup), 3630 (Silica Gel Cleanup), or 3640 (Gel-Permeation Cleanup) to help achieve lower detection limits.

- Some of the extended-list cPAH analytical standards (used by the laboratory for quantitation and quality control purposes) may be in very limited supply.

- Because toxicological information exists for the cPAHs on the extended list, MDH continues to recommend use of the extended list on sites where PAHs are contaminants of concern.

Policy

Based upon an evaluation of the likely sources of extended cPAHs in the environment, consistency with the U.S. EPA and other state remediation programs, current limitations of the analytical method, and 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 be consulted for assistance in evaluating the data and for guidance on improving the usability of data collected in the future.

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Date

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,j]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