WISCONSIN DNR
Department of Natural Resources

Soil PAH Background Study

Preliminary Planning/Scoping Discussion

with

Contaminated Materials Management and Contaminated Sediments Advisory Groups

October 23, 2015

What is “Background”?

UK statutory guidance Part 2a Environmental Protection Act 2012 Revision: ‘normal’ contaminant levels

- should not be considered to cause land to qualify as contaminated
- may result from the natural presence of contaminants at levels…typical in a given area and not been shown to pose an unacceptable risk…
- are caused by low level diffuse pollution and common human activity other than specific industrial processes

What is “Background”?

Finland Government Decree (214/2007)

- Geochemical baseline is the natural geochemical background concentration and superimposed diffuse anthropogenic input of elements in the topsoil

USGS “Area” Background

- concentrations of regulated substances that are consistently present in the environment in the vicinity of a site that are the result of natural conditions or human activities, and not the result solely of releases at the site

What is “Background”?

Are there other items that should be considered with respect to “Background”?

For the purposes of our proposed study, how should “Background” be defined?

Literature Review

- U.S.-based Studies:
  - USGS Chicago (2002-published 2008)
  - EPRI Illinois (2004)
  - EPRI Western NY (2003)
  - EPRI Pennsylvania (2008)
  - EPRI Data Mining (2008)
    - All solid studies, but with slightly different aims, site selection and analytical techniques that what we have been discussing
- International Studies:
  - UK, Scandinavia, Central Europe
  - Chinese cities
- WI Compliance Monitoring Data
  - Variable methods, inappropriate site selection criteria, wrong sampling depth intervals

Literature Review

- Are there other relevant studies that should be reviewed? Please provide recommended study information to Geoff and David.

- Assess compiling a table or database to summarize the available resources and past studies.

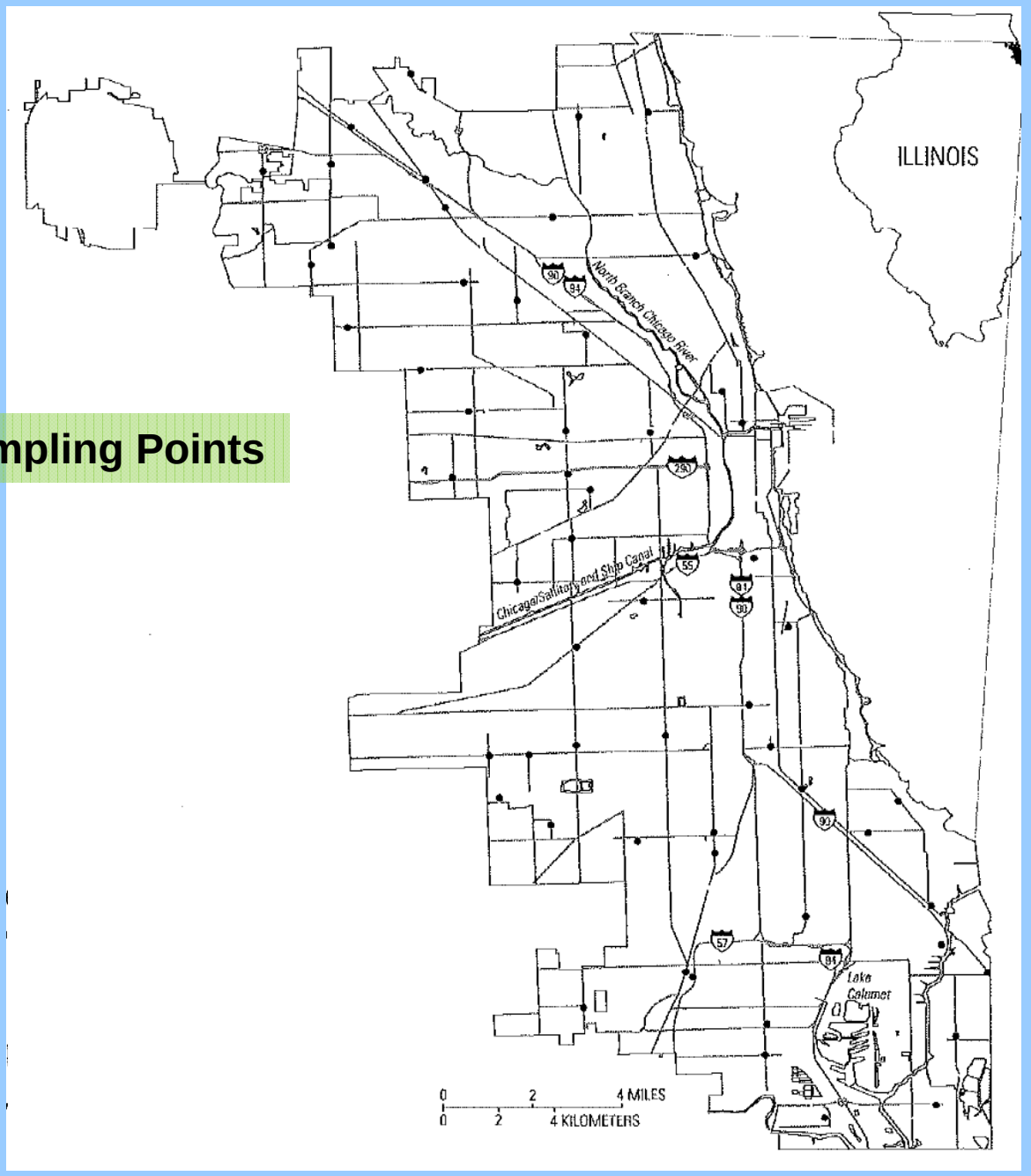
WISCONSIN DNR
Department of Natural Resources

Select PAH Study Results

- Chicago: USGS Ambient Surface Soils (2001-02)
- Madison Kipp: Off-Site Background Concentrations (2014)

USGS
Chicago Study

Areal Distribution of Sampling Points



Chicago Study
Benzo(a)pyrene Results Distribution

n = 57 samples

	ug/Kg
Maximum*	7,595
75th percentile	3,200
Median	1,000
25th percentile	270
Lowest	39
* 4 results exceeded maximum - considered outliers	

WI DC_{res} RCL = 15 ug/Kg

~1/2 is 2 orders of magnitude > WI RCL
and
Collected from 6-in. depth

Chicago Study

Benzo(a)pyrene Iso-concentration Contouring

Sampled upper 6 inches

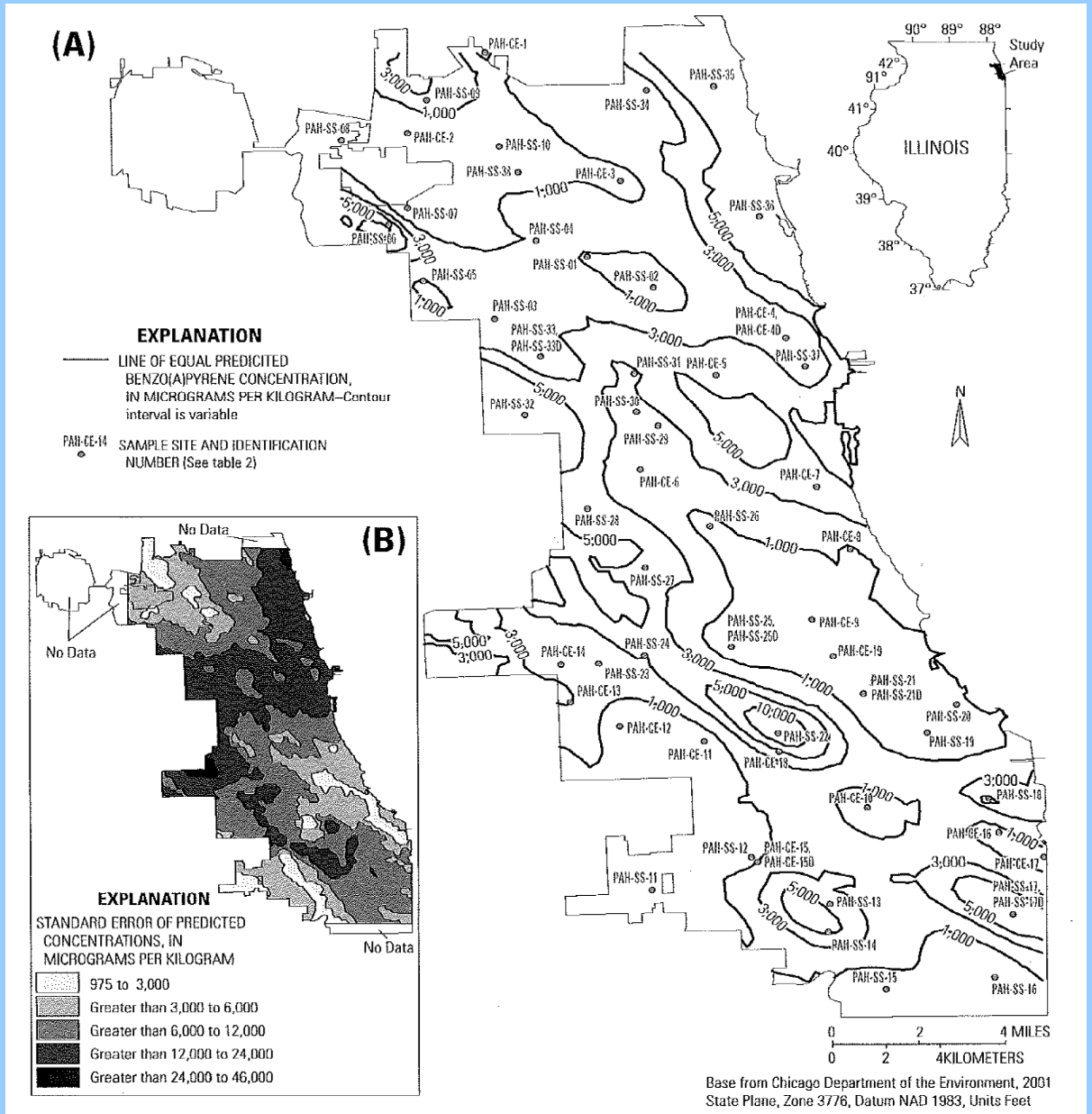
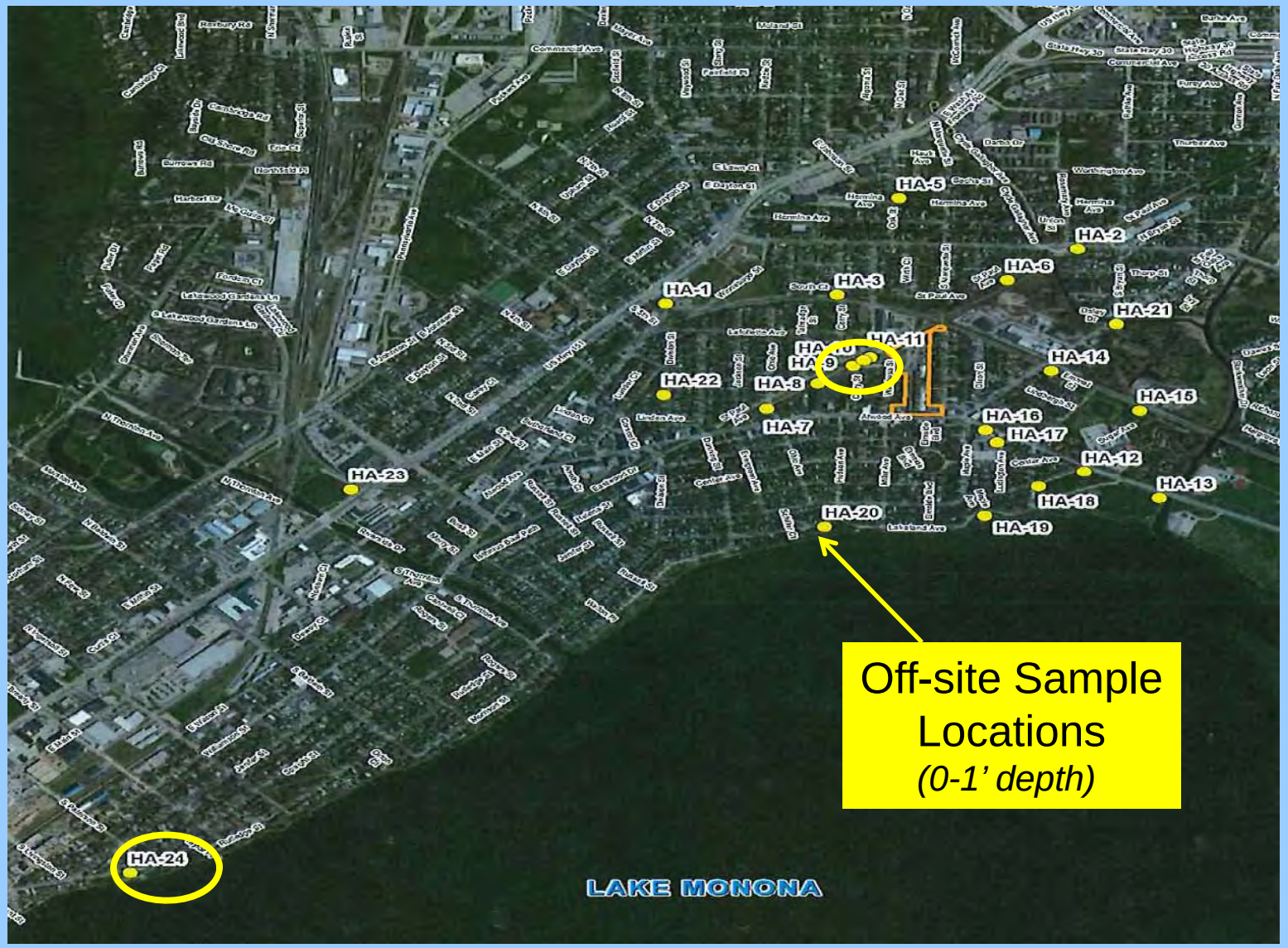
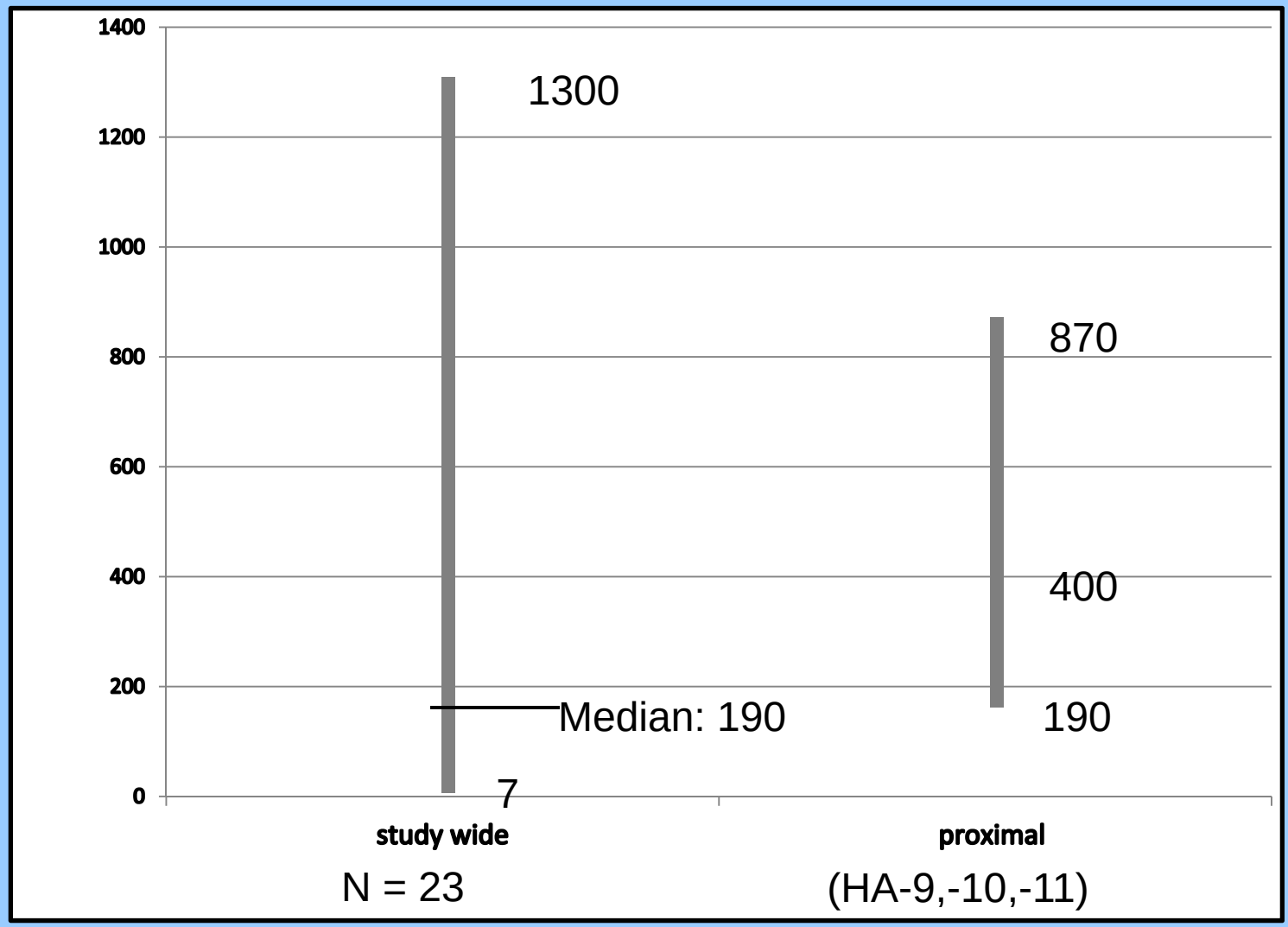


Figure 9. (A) Kriged concentrations of benzo(a)pyrene in ambient surface soils, Chicago, Illinois and (B) standard errors of predicted concentrations.



Madison-Kipp
PAH Background Study
(Arcadis, February 2014)

Madison Kipp
Benzo(a)pyrene
Results Distribution (ug/kg)

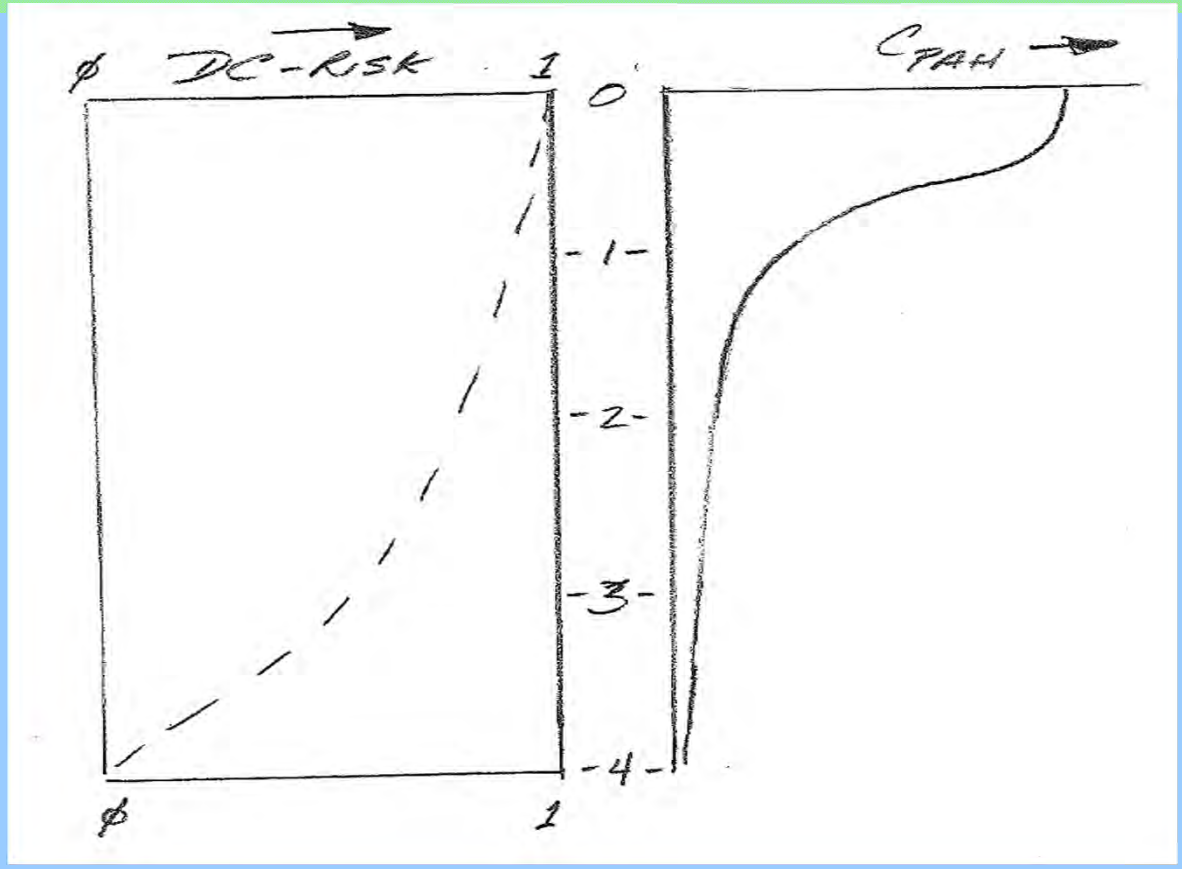


WISCONSIN DNR
Department of Natural Resources

Goals

1. Establish urban area wide, shallow ***soil*** background PAH levels
2. Determine PAH profiles with depth
3. Establish non-urban *soil* background PAH levels
4. Develop shallow PAH sampling protocols

Conceptual Risk and Contaminant Depth Profiles



PAH Regulatory Implications

Establish background levels

Use to assess remedial options

Re-evaluation of PAH risk

- Revise RCL calculations
- Assess risk attenuation with depth

WISCONSIN DNR
Department of Natural Resources

Possible Future Goals

Expand beyond initial Study area

Applicability to Fill

Applicability to Sediments

Sampling Location Criteria

- Subject to aerial deposition only
- Surface soil undisturbed for as long as possible (documenting last known disturbance)
- Proximity to atmospheric pollution point sources (smokestacks, historic rail lines) not relevant

Samples collected at surface (0-6”) for all sites

Samples collected at additional sites 6”-12”, 12”-24”, 24”-36”, 36”-48”.

Sampling Location Criteria

Site Selection Methods

- Randomized grid (USGS, EPRI)
- Transects- Urban to Rural
- Urban Growth Rings (Beijing)

Ideal: Undisturbed from pre-industrialization

Practical options:

- Parks
- Nature Preserves
- “Champion” Trees
- National/State Historic sites
- Cemeteries

Sampling Location Criteria

Any additional sample collection considerations?

Any site selection method concerns?

Any sample collection location recommendations?

Sampling Location Priorities

1. Metro Milwaukee/ Racine/ Kenosha
2. Green Bay/ Fox Valley
3. Superior
4. Madison

PAHs in USEPA Toxic Release Inventory

Name	CAS #	Name	CAS #
Acenaphthene	83-32-9	**Dibenzo(a,h)anthracene**	53-70-3
Acenaphtylene	208-96-8	Dibenzo(a,e)fluoranthene	5385-75-1
Anthracene	120-12-7	**Dibenzo(a,e)pyrene**	192-65-4
Benzo(a)anthracene	56-55-3	Dibenzo(a,h)pyrene	189-64-0
Benzo(a)phenanthrene (chrysene)	218-01-9	Dibenzo(a,l)pyrene	191-30-0
Benzo(a)pyrene	50-32-8	7H-Dibenzo(c,g)carbazole	194-59-2
Benzo(b)fluoranthene	205-99-2	**7,12-Dimethylbenz(a)anthracene**	57-97-6
Benzo(g,h,i)perylene	191-24-2	**Fluorene**	86-73-7
Benzo(j)fluoranthene	205-82-3	**Indeno(1,2,3-cd)pyrene**	193-39-5
Benzo(k)fluoranthene	207-08-9	**3-Methylcholanthrene**	56-49-5
Benzo(j,k)fluorene (fluoranthene)	206-44-0	5-Methylchrysene	3697-24-3
Benzo(r,s,t)pentaphene	189-55-9	1-Nitropyrene	5522-43-0
Dibenz(a,h)acridine	226-36-8	**Phenanthrene**	85-01-8
Dibenz(a,j)acridine	224-42-0	**Pyrene**	129-00-0

Analytical Methods

USEPA Method 8270/ ASTM Method D5739

- Collect in glass jars with teflon coated lids
- 5 day holding time (at 4°c)
- Soxhlet extraction (more work, but better results)
- Pre-concentration/ cleanup step
- Gas chromatograph-Mass spectrometer analysis
  - will allow for 'fingerprinting' to determine likely source of compounds
- Additional: TOC, % moisture, pH

Analytical Methods

Other considerations related to:

- Sample collection methods
- Analytical methods – extraction/analysis
- Parameter list

Possible Funding Sources

- USEPA
- WDNR
- Great Lakes related funding (except Madison)
- EPRI
- USDOE (Environmental Science Program)
- Municipalities
- Developer community
- Others?

Project Organizational Structure