Sources of Soil in Michigan

Different soil sources bring different background metal concentration
Michigan’s Glacial History

Each glacial lobe has different source rock and different background metal concentrations.
Michigan’s Glacial History & Michigan Background Soil Survey

Michigan Background Soil Survey
- Bedrock sources of glacial deposits & soil type affect natural metals content
- Glacial lobes divide metals data by geographic areas
- This information used to develop & update the Michigan Background Soil Survey
Michigan Background Soil Survey

1982 Quaternary Geology, Farrand and Bell
Evolution of the Michigan Background Soil Survey
An Example

Naturally Occurring Background = 5.8 ppm
Groundwater Surface Water Interface Protection Criteria = 4.6 ppm
A release of arsenic occurs from factory to native soil
Background of 5.8 ppm becomes the GSIP Criteria
Situation as illustrated in the panel.
Mellisa Powers-Taylor

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- PowersTaylorMI@michigan.gov
- Phone: 517-388-0795
Definition in Section 20101(1)(e)

"Background Concentration" means the concentration or level of a hazardous substance that exists in the environment at or regionally proximate to a facility that is not attributable to any release at or regionally proximate to the facility.

- Exists in the environment - (naturally occurring)
- Regionally proximate – (within similar geologic regions or glacial lobes)
- Not attributable to any release - (not anthropogenenic)
Natural vs. Anthropogenic

EPA Definitions*

1) *Naturally occurring Background* – Substances present in the environment in forms that have not been influenced by human activity (applicable to Michigan).

2) *Anthropogenic Background* – Natural and human-made substances present in the environment as a result of human activities, such as metals from slag or coal ash (not applicable to Michigan).

*(Remember, the Part 201 definition does not allow for a background determination from a release, hence we do not allow for an anthropogenic background)*

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*Frequently Asked Questions About the Development and Use of Background Concentrations at Superfund Sites, EPA, March 2018*
The Anthropocene Epoch

We live in the Anthropocene, a new Epoch
(a proposed geological epoch dating from the commencement of significant human impact on Earth's geology and ecosystem)

Nuclear Signature
Plastics
PCB’s, PFAS
Slag, Coal Ash
Pesticides
Leaded Gasoline
Climate Change

Stamp Sands - UP

Trinity nuclear test, 1945, the proposed start of the Anthropocene

Steel Slag Pile - France
Much of Detroit is Fill Material

Jeff Howard, WSU, et. al.
Why is Background Important?

Natural background levels can be higher than criteria

<table>
<thead>
<tr>
<th>ug/kg or ppb</th>
<th>Criteria</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>Direct Contact</td>
<td>7,600</td>
</tr>
<tr>
<td>Selenium</td>
<td>GSI Protection</td>
<td>400</td>
</tr>
<tr>
<td>Mercury</td>
<td>Vapor Intrusion</td>
<td>22*</td>
</tr>
</tbody>
</table>

* SS VIAC for sand

**MBSS Updated 2015

Figure 1. Locations of selected wells in southeastern Michigan and their concentrations of arsenic.
Part 201 - Section 324.20120a(10)
If the target detection limit or the background concentration for a hazardous substance is greater than a cleanup criterion developed for a category pursuant to subsection (1), the criterion is the target detection limit or background concentration, whichever is larger, for that hazardous substance in that category.

- If the...background concentration ...is greater than a cleanup criterion...the criterion is the...background concentration...

Part 201 Rules - R 299.6(5)(b)
A background concentration may be substituted for a generic cleanup criterion when the background concentration is higher than a criterion shown in R 299.44, R 299.46, or R 299.48 (even for acute)
Establishing Background – How Many Ways

Section 20101(1)(e) has four ways

i - Statewide Default Background Level

ii – Regional Background Level

iii - Other Approved Study

iv - Site-Specific Demonstration

*Modified in the 2012 changes to Part 201*
SOIL BACKGROUND and USE OF THE 2005 MICHIGAN BACKGROUND SOIL SURVEY

RESOURCE MATERIALS

Prepared by:
Michigan Department of Environment, Great Lakes, and Energy
Remediation and Redevelopment Division
525 West Allegan Street
Lansing, Michigan 48933
September 2019

Available online on the EGLE RRD website, under Resource Materials.
Fill Material – Does Background Apply?

Not necessarily!

First, a background concentration cannot be determined for fill since:

- a background concentration cannot be “attributable to a release”, and
- contaminated non-natural fill material is considered a release (it’s anthropogenic).

Second, existing background criteria do not apply since:

- these criteria apply to soils based on properties such as soil ingestion, dermal exposure, etc. and
- non-natural materials such as slag or ash do not have the same properties as soil.
Fill Material – some concepts

**Natural fill** – “Soil” that is unaltered by man from when it was originally deposited (glaciers/bedrock) and is not associated with a release.

**Non-natural fill** - Material that has been altered to contain hazardous substances like coal, clinker, slag, cement kiln dust, foundry sand, fly ash, etc.

**Native fill** – Soil that is from the same glacial lobe.

**Non-native fill** - Soil from a different glacial lobe.

Examples:

- Natural fill From the Huron-Erie lobe would be non-native but natural fill if moved to in the Michigan lobe. And the regional levels in the Michigan Lobe would apply. This could be a release.

- Natural fill moved **within** the Huron-Erie lobe is not a release **if** levels are below regional background and the fill stays in the lobe even if levels exceed residential criteria.
Fill Material – Does Background Apply?

Remember the four ways i, ii, iii, and iv

i. Statewide Default Background Level
   (remember criteria are based on soil)
   • Can be applied to natural fill
   • Not applicable to non-natural fill

ii. Regional – MBSSs
    • Cannot be determined for non-native fill
      • (with an exception)
      • Can be applied to non-native natural fill

iii. Other Approved Study - Not Applicable

iv. Site Specific - Under some circumstances
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- EGLE-RRD, Warren District
- HoinS@michigan.gov
- Phone: 586-487-0756
How to use background concentrations

Process for Non-metals

Analytical results ➔ Compare site concentrations to criteria
Establishing Background Concentrations

Section 20101(1)(e)

Four methods to determine background concentration:

(i) The value in the current criteria table (SDBL).
(ii) The value as determined in the 2005 Michigan Background Soil Survey (MBSS)
(iii) A value listed in a study conducted or approved by the department.
(iv) A site-specific demonstration.
## Statewide Default Background Levels (SDBLs)

<table>
<thead>
<tr>
<th>Hazardous Substance</th>
<th>Chemical Abstract Service Number</th>
<th>Statewide Default Background Level</th>
<th>Groundwater Protection</th>
<th>Indoor Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cobalt (B)</td>
<td>7440484</td>
<td>6,800</td>
<td>800</td>
<td>NLV</td>
</tr>
<tr>
<td>Copper (B)</td>
<td>7440508</td>
<td>32,000</td>
<td>5.80E+06</td>
<td>NLV</td>
</tr>
</tbody>
</table>

- Most **common** method to establish background concentrations
- SDBLs are **not** criteria... **unless** they exceed criteria
- Concentrations apply to **all soil types**, statewide
Section 20101(1)(e)

Four methods to determine background concentration:

(i) The value in the current criteria table (SDBL).

(ii) The value as determined in the Michigan Background Soil Survey (MBSS)

(iii) A value listed in a study conducted or approved by the department.

(iv) A site-specific demonstration.
2005 Michigan Background Soil Survey (MBSS)

2005 MBSS Summary

- Update to 1991 MBSS
- 926 soil samples (depending on metal)
- 25 metals
- Tables - two basic categories
  - Soil type – topsoil, sand and clay
  - Glacial lobe – Huron-Erie, Saginaw, Michigan and Superior
- Figures - Glacial lobe boundaries
- Statistical analysis of data
  - Number of samples in data set (n)
  - Mean (x) and standard deviation (SD)
  - Distribution – normal, lognormal and nonparametric
Updated 2015

Changes

- Up to 1795 soil samples, depending on metal

- Revised glacial lobe boundaries

- Use the same as 2005 MBSS (*Method ii – soil type and glacial lobe*)
Specific Requirements - Section 20101(1)(e)(ii)

- Must be **LESSER** of the following:
  
  - Uppermost value from typical range of data in **Table 1** – Statewide data
  
  - Value from **Tables 2 (topsoil), Table 3 (sand), or Table 4 (clay)** based on glacial lobe of site

- If Data Distribution = **Normal or lognormal**, use mean plus two standard deviations
  - At least 9 samples (n)

- If Data Distribution = **Nonparametric**, use median to calculate 97.5 quantile.
  - At least 10 samples (n)
Problem....

- 2005 MBSS not originally intended to establish background for Part 201 sites
- Mean plus 2 standard deviation and the 97.5 quantiles not provided

Solution

“Soil Background and the Use of the 2005 MBSS”

- RRD reference document
- Background concentrations from both 2005 MBSS and MBSS Updated 2015
- Revised tables including calculations
You want to establish a soil background concentrations using both the 2005 MBSS and the MBSS Updated 2015.

- Contaminants of concern - Chromium
- Soil at the site is sand
- Part 201 Site located in Mio in Oscoda County, Michigan
What Soil Type Is It?

- The soil that we are trying to establish a background concentration for determines what table to use:
  - Table 2 – Topsoil
  - Table 3 – Sand
  - Table 4 – Clay

In this example, we will use Sand – Table 3
MBSS and the Soil Type

- MBSS soil types **not** based on any standard soil classification
- Best professional judgement for **mixed soils** – sandy clay, clayey sands, etc.
- MBSS **cannot** be used if soil is marl, muck or peat
For this example, Site is in **Saginaw Glacial Lobe**
### Table 3 - Sand

<table>
<thead>
<tr>
<th>METAL</th>
<th>Dist.</th>
<th>Part 201 Statewide Default Background</th>
<th>Table 1 Upper Range Value</th>
<th>HURON - ERIE LOBE</th>
<th>SAGINAW LOBE</th>
<th>MICHIGAN LOBE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>97.5 Quantiles</td>
<td>97.5 Quantiles</td>
<td>Two Standard Deviations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>n</td>
<td>Two Standard Deviations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Al</td>
<td>L</td>
<td>6,900</td>
<td>16,324.0</td>
<td>2</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Sr</td>
<td>NA</td>
<td>2.5</td>
<td></td>
<td>1</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>As</td>
<td>5.8</td>
<td>27.7</td>
<td></td>
<td>34</td>
<td>19.6</td>
<td>#</td>
</tr>
<tr>
<td>Ba</td>
<td>27.5</td>
<td>220.0</td>
<td></td>
<td>22</td>
<td>612</td>
<td>#</td>
</tr>
<tr>
<td>Be</td>
<td>non</td>
<td>1.8</td>
<td></td>
<td>3</td>
<td>--</td>
<td>#</td>
</tr>
<tr>
<td>Cd</td>
<td>non</td>
<td>1.2</td>
<td>2.5</td>
<td>22</td>
<td>#</td>
<td>2.0</td>
</tr>
<tr>
<td>Cr</td>
<td>L</td>
<td>18</td>
<td>55.0</td>
<td>22</td>
<td>20.3</td>
<td>#</td>
</tr>
<tr>
<td>Co</td>
<td>non</td>
<td>6.8</td>
<td>12.0</td>
<td>2</td>
<td>29.7</td>
<td>#</td>
</tr>
<tr>
<td>Cu</td>
<td>L</td>
<td>32</td>
<td>58.0</td>
<td>22</td>
<td>--</td>
<td>#</td>
</tr>
<tr>
<td>Fe</td>
<td>L</td>
<td>12,000</td>
<td>34,233.0</td>
<td>2</td>
<td>--</td>
<td>#</td>
</tr>
<tr>
<td>Pb</td>
<td>L</td>
<td>21</td>
<td>45.0</td>
<td>25</td>
<td>25.3</td>
<td>#</td>
</tr>
<tr>
<td>Li</td>
<td>L</td>
<td>9.8</td>
<td>41.0</td>
<td>2</td>
<td>--</td>
<td>#</td>
</tr>
<tr>
<td>Mg</td>
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<td>29,875.0</td>
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<td>--</td>
<td>#</td>
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<tr>
<td>Mn</td>
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<td>440</td>
<td>1,391.0</td>
<td>2</td>
<td>--</td>
<td>#</td>
</tr>
<tr>
<td>Hg</td>
<td>non</td>
<td>0.13</td>
<td>0.6</td>
<td>17</td>
<td>#</td>
<td>0.40</td>
</tr>
<tr>
<td>Mo</td>
<td>--</td>
<td>NA</td>
<td>100% ND</td>
<td>2</td>
<td>--</td>
<td>#</td>
</tr>
<tr>
<td>Ni</td>
<td>L</td>
<td>20</td>
<td>39.0</td>
<td>8</td>
<td>--</td>
<td>#</td>
</tr>
<tr>
<td>Se</td>
<td>non</td>
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<td>1.2</td>
<td>18</td>
<td>--</td>
<td>0.50</td>
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<tr>
<td>Ag</td>
<td>non</td>
<td>1</td>
<td>2.0</td>
<td>8</td>
<td>--</td>
<td>#</td>
</tr>
<tr>
<td>Ti</td>
<td>N</td>
<td>MNL</td>
<td>217.0</td>
<td>2</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>V</td>
<td>L</td>
<td>NA</td>
<td>89.0</td>
<td>2</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Cr background concentration is **20 ppm**
**Table 3 - SAND**

<table>
<thead>
<tr>
<th>Dist.</th>
<th>Part 201 Statewide Default Background</th>
<th>Table 1 Upper Range Value</th>
<th>HURON - ERIE</th>
<th>SAGINAW</th>
<th>MICHIGAN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>2 SD</td>
<td>97.5 Quantiles</td>
<td>n</td>
<td>2 SD</td>
</tr>
<tr>
<td>Aluminum</td>
<td>L</td>
<td>6,900</td>
<td>16,014</td>
<td>31</td>
<td>8,233</td>
</tr>
<tr>
<td>Antimony</td>
<td>N</td>
<td>NA</td>
<td>11.5</td>
<td>15</td>
<td>#</td>
</tr>
<tr>
<td>Arsenic (As)</td>
<td>L</td>
<td>5.8</td>
<td>22.8</td>
<td>175</td>
<td>26.3</td>
</tr>
<tr>
<td>Barium (Ba)</td>
<td>L</td>
<td>75</td>
<td>172</td>
<td>103</td>
<td>199</td>
</tr>
<tr>
<td>Beryllium (Be)</td>
<td>Np</td>
<td>1</td>
<td>1</td>
<td>31</td>
<td>#</td>
</tr>
<tr>
<td>Cadmium (Cd)</td>
<td>Np</td>
<td>1.2</td>
<td>2</td>
<td>97</td>
<td>#</td>
</tr>
<tr>
<td>Chromium (Cr)</td>
<td>L</td>
<td>18</td>
<td>55.6</td>
<td>67</td>
<td>30.4</td>
</tr>
<tr>
<td>Cobalt (Co)</td>
<td>CL</td>
<td>6.8</td>
<td>26.8</td>
<td>78</td>
<td>17.9</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>L</td>
<td>32</td>
<td>50.6</td>
<td>116</td>
<td>23.5</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>L</td>
<td>12,000</td>
<td>34,311</td>
<td>36</td>
<td>21,359</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>CL</td>
<td>21</td>
<td>38.9</td>
<td>132</td>
<td>24.1</td>
</tr>
<tr>
<td>Lithium (Li)</td>
<td>V</td>
<td>9.8</td>
<td>37.9</td>
<td>7</td>
<td>9.6</td>
</tr>
<tr>
<td>Magnesium (Mg)</td>
<td>L</td>
<td>NA</td>
<td>36,049</td>
<td>18</td>
<td>15,008</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>L</td>
<td>440</td>
<td>1,212</td>
<td>24</td>
<td>873</td>
</tr>
<tr>
<td>Mercury (Hg)</td>
<td>Np</td>
<td>0.13</td>
<td>0.5</td>
<td>102</td>
<td>#</td>
</tr>
<tr>
<td>Molybdenum (Mo)</td>
<td>Np</td>
<td>NA</td>
<td>5</td>
<td>17</td>
<td>#</td>
</tr>
<tr>
<td>Nickel (Ni)</td>
<td>V</td>
<td>20</td>
<td>55.2</td>
<td>49</td>
<td>30</td>
</tr>
<tr>
<td>Selenium (Se)</td>
<td>Np</td>
<td>0.41</td>
<td>1.3</td>
<td>109</td>
<td>#</td>
</tr>
<tr>
<td>Silver (Ag)</td>
<td>Np</td>
<td>1</td>
<td>1.4</td>
<td>92</td>
<td>#</td>
</tr>
<tr>
<td>Sodium (Na)</td>
<td>V</td>
<td>NA</td>
<td>519</td>
<td>17</td>
<td>487</td>
</tr>
<tr>
<td>Strontium (Sr)</td>
<td>Np</td>
<td>NA</td>
<td>150</td>
<td>4</td>
<td>#</td>
</tr>
<tr>
<td>Thallium (Tl)</td>
<td>Np</td>
<td>NA</td>
<td>2.7</td>
<td>39</td>
<td>#</td>
</tr>
<tr>
<td>Titanium (Ti)</td>
<td>N</td>
<td>MNL</td>
<td>208</td>
<td>4</td>
<td>239</td>
</tr>
<tr>
<td>Vanadium (V)</td>
<td>L</td>
<td>NA</td>
<td>59.6</td>
<td>39</td>
<td>38.5</td>
</tr>
<tr>
<td>Zinc (Zn)</td>
<td>L</td>
<td>47</td>
<td>118</td>
<td>115</td>
<td>85.8</td>
</tr>
</tbody>
</table>

**Cr background concentration is 19.7 ppm**
Hoskins Manufacturing OPTIONS.....

<table>
<thead>
<tr>
<th>Saginaw Lobe, Sand (mg/kg or ppm)</th>
<th>2005 MBSS</th>
<th>MBSS Updated 2015</th>
<th>Statewide Default Background Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td><strong>20.0</strong></td>
<td>19.7</td>
<td>18</td>
</tr>
</tbody>
</table>
# Hoskins - Compare to Criteria

<table>
<thead>
<tr>
<th></th>
<th>2005 MBSS Background Concentration</th>
<th>Part 201 Drinking Water Protection Criteria</th>
<th>Part 201 GSI Protection Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td>20</td>
<td>30</td>
<td>3.3</td>
</tr>
</tbody>
</table>

GSI Protection Criteria becomes 20 ppm
MBSS Hacks

- Sites located at or near glacial lobe boundaries
- Can use different background methods for various metals at the same site
- For each different soil type, there must be a different soil background even on same site
Establishing Background Concentrations

Section 20101(1)(e)

Four methods to determine background concentration:

(i) The value in the current criteria table (SDBL).
(ii) The value as determined in the 2005 Michigan Background Soil Survey (MBSS)
(iii) A value listed in a study conducted or approved by the department.
(iv) A site-specific demonstration.
Other Study or Survey

- Must be conducted or approved by EGLE

- NO study or survey approved to be used using this method.

- Cannot used MBSS Table 1 – Statewide Upper Range value under Method iii
Section 20101(1)(e)

Four methods to determine background concentration:

(i) The value in the current criteria table (SDBL).
(ii) The value as determined in the 2005 Michigan Background Soil Survey (MBSS)
(iii) A value listed in a study conducted or approved by the department.
(iv) A site-specific demonstration.
Establishing Site-Specific Backgrounds

Soil Sampling

- On or close proximity to the site
- Areas representing naturally occurring concentrations
- Discrete samples or incremental sampling
- Same soil type, depth and topographic situation as facility samples
- At least 9 samples in each soil horizon or incremental sampling

Example 1.1 Collection of BACKGROUND When Multiple Soil Horizons are Present

- Brown medium-coarse SAND
  - 9 samples
- Light brown silty fine SAND
  - 9 samples
- Gray silty CLAY with trace of fine-medium sand
  - 9 samples

Sampling Strategies and Statistics Training Materials for Part 201 Criteria, DEQ, 2002
Establishing Site-Specific Backgrounds

Areas inappropriate to sample to establish site-specific background:

- Fill areas
- Areas in which management, treatment, handling, storage or disposal activities of any of the following are known or suspected to have occurred: hazardous substances or petroleum, solid or hazardous wastes, or waste waters
- Areas within three feet of a roadway
- Parking lots and areas surrounding parking lots or other paved areas
- Railroad tracks or railway areas or other areas affected by their runoff
- Areas of concentrated air pollutant depositions or areas affected by their runoff
- Ditches presently or historically receiving industrial or urban runoff
- Areas within three feet of any current or former structure which was likely to have been painted with lead-based paint.
Establishing Site-Specific Background Calculation

- Distribution
- Non-detects
- Outliers

Mean + 3 Standard Deviations

Site-Specific Soil Background Concentration
Establishing Site-Specific Background Calculation

Sampling Strategies and Statistics Training Materials for Part 201 Cleanup Criteria

Available online on the EGLE RRD website, under Resource Materials.
Establishing Site-Specific Backgrounds

**Site-Specific Soil Background Report** should include:

a) **Historical summary** of background soil sample area with resources attached

b) Discussion on background soil sample **grain size and depth** and how they are similar to grain size and depth of the site samples

c) Discussion of **outlier** test results and data **distribution** analyses, with supporting statistical outputs

d) Approach for addressing **non-detect** data in the background data

e) Laboratory **analytical** report(s)

f) Scaled **map** depicting location of soil samples.

g) Documentation of the statistical calculations used to evaluate dataset and determine **site-specific background concentration(s)**

**RRD review and approval of site-specific soil background concentrations is required, Section 20120b**
QUESTIONS

Melissa Kendzierski

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- Kendzierskim@michigan.gov
- Phone: 989-619-5015
Other Options when Background is not Applicable

- Soil Leaching
- Hexavalent Chromium
- Bioavailability
Soil Leaching

- Used when concentrations exceed applicable generic criteria.
- Leach testing may be conducted to demonstrate compliance for soils.
- Methods defined in R 299.5722(3)(1)
  - Toxicity Characteristic Leaching Procedure (TCLP)
  - Synthetic Precipitation Leaching Procedure (SPLP)
  - Others as determined by the Department
# Hexavalent Chromium

<table>
<thead>
<tr>
<th>Hazardous Substance</th>
<th>Residential Criteria</th>
<th>Groundwater Surface Water Interface Protection Criteria</th>
<th>Direct Contact Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous Substance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statewide Default Background Level</td>
<td>18,000 (total)</td>
<td>30,000</td>
<td>2.50E+06</td>
</tr>
<tr>
<td>Residential Drinking Water Protection Criteria</td>
<td>1.0E+9 (D)</td>
<td>(G,X)</td>
<td>2.60E+05</td>
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<tr>
<td>Particulate Soil Inhalation Criteria</td>
<td>3.30E+08</td>
<td>3,300</td>
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</tr>
<tr>
<td>Direct Contact Criteria</td>
<td>7.90E+08</td>
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</tbody>
</table>
Bioavailability of Metals in Soil

- **Bioavailability**: the extent to which a chemical can be absorbed by a living organism

- Relevant for:
  - Arsenic
  - Cadmium
  - Chromium
  - Lead
  - Mercury
  - Nickel

- Site Specific Criteria: Direct Contact Pathway Only – Contact You District Point of Contact

- Useful when a metal is the driver for remediation
Bioavailability of Metals

Michigan sites where bioavailability testing has been used to develop site-specific direct contact criteria

- **Crego Park** — Arsenic (Lansing District)
- **Marysville Manufactured Gas Plant Site** — Arsenic (Warren District – Emily Bertolini)
- **Alpena Hide and Leather** — Arsenic and Lead (Gaylord District – Janice Adams)
- **Franklin Partners Former Sunshine Church property** — Arsenic (Grand Rapids District – David Bandlow)
- **Orchardview Housing** — Arsenic (Cadillac District – Brian Flickinger)
- **Leslie Science and Nature Center** (Jackson District – Mary Miller & Sara Nedrich)

For a complete list of site or for more information – Contact your District Point of Contact
# Soil Background TAPS

## Point of Contacts

<table>
<thead>
<tr>
<th>District/Section</th>
<th>Team Member</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaylord</td>
<td>Melissa Kendzierski - Leader</td>
<td><a href="mailto:kendzierskim@michigan.gov">kendzierskim@michigan.gov</a></td>
</tr>
<tr>
<td>Cadillac</td>
<td>Brian Flickinger</td>
<td><a href="mailto:flickingerb@michigan.gov">flickingerb@michigan.gov</a></td>
</tr>
<tr>
<td>Gaylord</td>
<td>Amy Pitts</td>
<td><a href="mailto:pittsa4@michigan.gov">pittsa4@michigan.gov</a></td>
</tr>
<tr>
<td>Grand Rapids</td>
<td>Peter Van Heest</td>
<td><a href="mailto:vanheestp@michigan.gov">vanheestp@michigan.gov</a></td>
</tr>
<tr>
<td>Jackson</td>
<td>Dan Hamel</td>
<td><a href="mailto:hameld@michigan.gov">hameld@michigan.gov</a></td>
</tr>
<tr>
<td>Kalamazoo</td>
<td>Michael Baranoski</td>
<td><a href="mailto:baranoskim@michigan.gov">baranoskim@michigan.gov</a></td>
</tr>
<tr>
<td>Kalamazoo</td>
<td>Pablo Mora</td>
<td><a href="mailto:morap@michigan.gov">morap@michigan.gov</a></td>
</tr>
<tr>
<td>Lansing</td>
<td>Dwight Cummings</td>
<td><a href="mailto:cummingsd@michigan.gov">cummingsd@michigan.gov</a></td>
</tr>
<tr>
<td>Lansing</td>
<td>Michael Eggleston</td>
<td><a href="mailto:egglestonm@michigan.gov">egglestonm@michigan.gov</a></td>
</tr>
<tr>
<td>Marquette</td>
<td>Elizabeth Goetz</td>
<td><a href="mailto:goetze@michigan.gov">goetze@michigan.gov</a></td>
</tr>
<tr>
<td>Warren</td>
<td>Steve Hoin</td>
<td><a href="mailto:hoins@michigan.gov">hoins@michigan.gov</a></td>
</tr>
<tr>
<td>Superfund</td>
<td>Mellisa Powers-Taylor</td>
<td><a href="mailto:powerstaylorm@michigan.gov">powerstaylorm@michigan.gov</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-RRD Team Member</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMD</td>
<td>Dale Bridgford</td>
</tr>
</tbody>
</table>
Questions?

GEOLOGY

What I think I do

What society thinks I do

What my friends think I do

What I actually do