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Environmental Engineering and Ground Water Consulting

May 5, 2014

Amendment No. 2 to Soil Re-Use Management Plan
for
Century Mills Estates Subdivision, Bolton, Massachusetts

Prepared for:

Lighthouse Environmental Mgt, LLC
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The following is the second amendment to the Soil Re-Use Management Plan (SRMP) dated September 5, 2013 prepared for Century Mills Estates Subdivision (Century Mills), Bolton, Massachusetts by Cardno ATC of Woburn, Massachusetts.

The initial amendment dated December 23, 2013 revised the Soil Acceptance Criteria Table for Century Mills based upon the recently published Similar Soils Provision Guidance (WSC# 13-500) document issued by the Massachusetts Department of Environmental Protection (MassDEP) dated October 2, 2013.

The purpose of this second amendment is to revise the Soil Acceptance Criteria Table for Century Mills based upon recent changes to the reportable concentrations for the following elemental metals; cadmium, chromium (total), chromium (VI), lead and nickel that became effective on April 25, 2014. In all other respects, there are no other changes to the SRMP.

Similar Soils Provision Guidance (WSC# 13-500) Background

The Similar Soils Provision Guidance policy was developed to address the very specific application of an MCP provision (310 CMR 40.0032(3)) that allows certain soils to be managed (and re-used) without prior notice to, or approval from, MassDEP with the specific intent of crafting an instrument to assist in managing re-use of soil in reclamation and development projects such as Century Mills.

The policy describes four requirements that must be met before managed soil can be moved to and re-used (or disposed) at a new location without notice to or approval from MassDEP. Those requirements are that the managed soil:

1. Must Not Be a Hazardous Waste.
2. Must Be Less Than Reportable Concentrations (RCs).
3. Must Not Create a Notifiable Condition at the Receiving Location.
4. Must Not Be Significantly More Contaminated Than the Soil at the Receiving Location (also referred to as the "anti-degradation provision").

While these requirements are discussed in detail in the guidance document, which has been included as **Attachment 1**, the focus if this SRMP Amendment No. 2 is Requirement # 4, which establishes revised threshold criteria for cadmium, chromium (total), chromium (VI), lead and nickel

Revised Century Mills Soil Acceptance Criteria

The Century Mills Soil Acceptance Criteria has been revised to reflect the limiting concentrations for cadmium, chromium (total), chromium (VI), lead and nickel that reflect the change in the reportable concentration for these metals assuming the soils at the receiving location are natural background. Applying the "Rule of Thumb Multiplier" to background concentrations for the above-reverenced metals, the revised limiting soil concentration based upon the new reportable concentrations is summarized in the following table:

Parameter	Background Concentration*	Rule of Thumb Multiplier**	Multiplied Value**	New RC (effective 4/25/14)	RCS-1 Limiting Soil Concentration based on new RC**
Cadmium	2	10	20	70	<20
Chromium (total)	30	7.5	225	100	<100
Chromium (VI)	30	7.5	225	100	<100
Lead	100	5	500	200	<200
Nickel	20	7.5	150	600	<150

Notes:

1. All units are expressed in mg/kg
2. * Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil (May, 2002)
3. ** Similar Soils Provision Guidance (WSC# 13-500)

The revised Century Mills Soil Acceptance Criteria (**Table 1 Revised 5/5/2014**) that incorporates these changes is included as **Attachment 3**. VOCs, PCBs, TPH, TCLP lead and General Chemistry results from the original SRMP acceptance criteria, for which background concentrations have not been established, have been incorporated into the revised table.

Attachments

Attachment 1 Similar Soils Provision Guidance (WSC# 13-500)
Attachment 2 Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil (May, 2002)
Attachment 3 Century Mills Soil Acceptance Criteria Table 1 (Revised 5/4/2014)

Attachment 1

Similar Soils Provision Guidance (WSC# 13-500)

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
One Winter Street Boston, MA 02108 • 617-292-5500

DEVAL L. PATRICK
Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

October 2, 2013

Dear Interested Party:

The Massachusetts Department of Environmental Protection (MassDEP) is pleased to announce the publication of the "Similar Soils Provision Guidance" (WSC#-13-500). This guidance is provided to parties conducting response actions at disposal sites regulated under the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000, to support the assessment and re-use of soil in compliance with the related provisions of the MCP.

This policy addresses the very specific application of an MCP provision (310 CMR 40.0032(3)) that allows certain soils to be managed (and re-used) without prior notice to, or approval from, the Department. MassDEP recognizes that this is but one piece of a much needed comprehensive soil management strategy. The Department is committed to working with external stakeholders to revise areas of regulation and policy to enhance, expedite and more efficiently manage the assessment and appropriate re-use of soil in reclamation and development projects.

I would like to thank the many program stakeholders who have provided valuable input in the development of this document.

Sincerely,

Benjamin J. Ericson
Assistant Commissioner
Bureau of Waste Site Cleanup

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Similar Soils Provision Guidance

Guidance for Identifying When Soil Concentrations at a Receiving Location Are "Not Significantly Lower Than" Managed Soil Concentrations Pursuant to 310 CMR 40.0032(3)

October 2, 2013

WSC#-13-500

The information contained in this document is intended solely as guidance. This guidance does not create any substantive or procedural rights, and is not enforceable by any party in any administrative proceeding with the Commonwealth. Parties using this guidance should be aware that there may be other acceptable alternatives for achieving and documenting compliance with the applicable regulatory requirements and performance standards of the Massachusetts Contingency Plan.

I. Purpose and Scope

The Massachusetts Contingency Plan ("MCP", 310 CMR 40.0000) establishes conditions and requirements for the management of soil excavated at a disposal site. This guidance addresses the specific requirements of 310 CMR 40.0032(3) and the criteria by which a Licensed Site Professional ("LSP") may determine that soil may be moved without prior notice to or approval from the Department. Soil managed pursuant to 310 CMR 40.0032(3) may be transported using a Bill of Lading ("BOL"), but a BOL is not required. Attachment 1 provides a flowchart depiction of the Similar Soil regulations and guidance.

This guidance is not applicable to the excavation and movement of soil from locations other than M.G.L. Chapter 21E disposal sites, nor to the management of soils considered Remediation Waste under the MCP.

II. Relationship to Other Local, State or Federal Requirements

This guidance is intended to clarify and more fully describe regulatory requirements contained within the MCP. Nothing in this guidance eliminates, supersedes or otherwise modifies any local, state or federal requirements that apply to the management of soil, including any local,

state or federal permits or approvals necessary before placing the soil at the receiving location, including, *but not limited to,* those related to placement of fill, noise, traffic, dust control, wetlands, groundwater or drinking water source protection.

III. Requirements of 310 CMR 40.0032(3)

The requirements specified in 310 CMR 40.0032(3) are:

> (3) Soils containing oil or waste oil at concentrations less than an otherwise applicable Reportable Concentration and that are not otherwise a hazardous waste, and soils that contain one or more hazardous materials at concentrations less than an otherwise applicable Reportable Concentration and that are not a hazardous waste, may be transported from a disposal site without notice to or approval from the Department under the provisions of this Contingency Plan, provided that such soils:
>
> (a) are not disposed or reused at locations where the concentrations of oil or hazardous materials in the soil would be in excess of a release notification threshold applicable at the receiving site, as delineated in 310 CMR 40.0300 and 40.1600; and
>
> (b) are not disposed or reused at locations where existing concentrations of oil and/or hazardous material at the receiving site are significantly lower than the levels of those oil and/or hazardous materials present in the soil being disposed or reused.

There are therefore four requirements that must be met before the managed soil can be moved to and re-used (or disposed) at a new location without notice to or approval from MassDEP. Each requirement (A. through D.) is addressed below.

A. The Managed Soil Must Not Be a Hazardous Waste

310 CMR 40.0032(3) applies to soils containing oil or waste oil that are not otherwise a hazardous waste, and to soils containing hazardous materials that are not a hazardous waste. The MCP definition of hazardous waste (310 CMR 40.0006) refers to the definitions promulgated in the Massachusetts Hazardous Waste Regulations, 310 CMR 30.000.

Under the federal Resource Conservation and Recovery Act of 1976 ("RCRA", 42 U.S.C. §§6901 *et. seq.*), the Massachusetts Hazardous Waste Management Act (M.G.L. c.21C), and the Massachusetts Hazardous Waste Regulations (310 CMR 30.000), soil is considered to contain a hazardous waste (hazardous waste soil) if, when generated, it meets either or both of the following two conditions:

- the soil exhibits one or more of the characteristics of a hazardous waste pursuant to 310 CMR 30.120 [such as exhibiting a characteristic of toxicity under 310 CMR 30.125 and 30.155 (Toxicity Characteristic Leaching Procedure, or TCLP)]; or
- the soil contains hazardous constituents from a listed hazardous waste identified in 310 CMR 30.130 or Title 40, Chapter I, Part 261 (Identification and Listing of Hazardous Waste) of the Code of Federal Regulations.

MassDEP has published a Technical Update entitled: *Considerations for Managing Contaminated Soil: RCRA Land Disposal Restrictions and Contained-In Determinations* (August 2010, http://www.mass.gov/eea/docs/dep/cleanup/laws/contain.pdf) that focuses on the determination of whether contaminated soil must be managed as a hazardous waste subject to RCRA requirements, and the presumptive approval process an LSP/PRP can use to document such a determination.

B. The Managed Soil Must Be Less Than Reportable Concentrations (RCs).

This requirement is intended to ensure that the soil being excavated and relocated from a disposal site is not "Contaminated Soil" and therefore neither "Contaminated Media" nor "Remediation Waste" as those terms are defined in 310 CMR 40.0006[1].

310 CMR 40.0361 sets forth two reporting categories for soil (RCS-1 and RCS-2). Reporting Category RCS-1 applies to locations with the highest potential for exposure, such as residences, playgrounds and schools, and to locations within the boundaries of a groundwater resource area. Reporting Category RCS-2 applies to all other locations.

Note that the "applicable Reportable Concentrations" referred to in 310 CMR 40.0032(3) may be the RCS-1 or RCS-2 criteria, depending upon which category would apply to the soils being excavated *at the original disposal site location*, not the RCs applicable to the soils at the receiving location (see Section III.C. below).

> **EXAMPLE:** If soil is being excavated from a disposal site at an RCS-2 location and the soil contaminant concentrations are found to be less than the RCS-2 criteria, then the soil is not "Contaminated Soil" since the soil is less than the release notification threshold established for RCS-2 soil by 310 CMR 40.0300 and 40.1600. The RCS-2 soil in this example is not "Contaminated Soil" even if one or more constituent concentration is greater than an RCS-1 value.

Also, the language at 310 CMR 40.0032(3) specifies the *applicable* RCs. If a notification exemption (listed at 310 CMR 40.0317) applies to the OHM in soil at its original location, then the corresponding Reportable Concentration is not *applicable*. Thus 310 CMR 40.0032(3) should be read to apply to soils containing concentrations of oil or hazardous material ("OHM") less than the applicable RCs *or* covered by a notification exemption. This interpretation of the requirement is consistent with the definition of Contaminated Soil, which uses the term "notification threshold" rather than "Reportable Concentration."

[1] Contaminated Soil - means soil containing oil and/or hazardous material at concentrations equal to or greater than a release notification threshold established by 310 CMR 40.0300 and 40.1600.

Contaminated Media - means Contaminated Groundwater, Contaminated Sediment, Contaminated Soil, and/or Contaminated Surface Water.

Remediation Waste - means any Uncontainerized Waste, Contaminated Media, and/or Contaminated Debris that is managed pursuant to 310 CMR 40.0030. The term "Remediation Waste" does not include Containerized Waste.

C. The Managed Soil Must Not Create a Notifiable Condition at the Receiving Location.

This requirement is intended to prevent the creation of new reportable releases that must be subsequently assessed and remediated.

If the contaminant concentrations in the soil being relocated are less than the RCS-1 criteria, then placement of the soil in any RCS-1 location would not create a new notifiable condition. There are, however, conditions that could result in a notifiable condition.

First, if the soil is excavated from an RCS-2 location (as described in the example in Section III.B. above) with contaminant concentrations *between* the RCS-1 and RCS-2 criteria, then the placement of that soil at an RCS-1 receiving location would create a notifiable condition since one or more concentrations of OHM would then exceed the RCS-1 criteria in the RCS-1 receiving location.

Second, a notification exemption that applies to the original location of the soil may not apply to the receiving location. (For example, the lead paint exemption at 310 CMR 40.0317(8) is specific to "the point of application.") In cases where a notification exemption applies only to the original location, the managed soil must be evaluated solely based on whether its OHM concentrations exceed the applicable RCs at the receiving location.

D. The Managed Soil Must Not Be Significantly More Contaminated Than the Soil at the Receiving Location.

This requirement has been referred to as the "anti-degradation provision" although it is more accurately described as the "Similar Soils Provision." 310 CMR 40.00032(3)(b) requires that the concentrations of OHM at the receiving location not be "significantly lower" than the relocated soil OHM concentrations. One could also say that the provision requires that "there is no significant difference between the relocated soil and the soil at the receiving location," or that "the soils being brought to the receiving location are similar to what is already there." This requirement embodies several considerations.

First, as a general principle, M.G.L. c.21E is intended to clean up contaminated properties and leave them better than they started -- even to clean sites to background conditions, if feasible. It would be inconsistent with this principle to then raise the ambient levels of contamination in the environment as a consequence of a response action conducted under the MCP.

Second, despite the three other requirements (A. through C. above) of 310 CMR 40.0032(3), decisions about the movement of the managed soil will be based upon sampling of soil that is likely to have significant heterogeneity. The Similar Soils Provision is an additional measure to minimize the adverse effects of soil characterization that may not be representative of such heterogeneity.

Third, none of the criteria of 310 CMR 40.0032(3) address the question of whether the soil poses a *risk* in its original or receiving location, although the hazardous waste- and notification-related requirements seem to *imply* risk-based decision making. Put simply, soil that is not a hazardous waste and does not require notification may still pose incremental risk at the receiving location. The Similar Soils Provision is intended to ensure that the managed soil does not increase risk of harm to health, safety, public welfare or the environment at the receiving location, since it will be similar to what is already there.

The "not… significantly lower" language of 310 CMR 40.0032(3)(b) can be interpreted to mean either a quantitative "not statistically different" analysis, or a semi-quantitative, albeit somewhat subjective, approach. MassDEP does not believe that a statistics-driven quantitative approach is necessary when comparing managed soil to known or assumed background conditions, given (a) the relatively low concentrations at issue and (b) the cost of such an analysis, driven by the quantity of sampling needed to show a statistical difference.

The regulations imply that the LSP must have knowledge about the concentrations of OHM in the soil at the receiving location in order to apply the Similar Soils Provision. The regulations also imply that the new soil may contain concentrations of OHM that are *somewhat* higher than those levels at the receiving location – just not "significantly" higher.

MassDEP recognizes that there may be several approaches to address this "knowledge" issue when implementing the Similar Soils Provision of the MCP.

- **Assume the soils at the receiving location are natural background**. Sampling of the soil at the receiving location is not necessary if it is assumed that the concentrations of OHM there are consistent with natural background conditions. MassDEP acknowledges that there is a range of background levels, and that the concentrations at any given location may be lower than the statewide levels published by the Department[2], but the costs associated with determining site-specific background are not justified by likely differences. Further, the published "natural background" levels are similarly used in several areas of the MCP as an acceptable endpoint, including site delineation and the development of the MCP cleanup standards.

  Of course, routine due diligence about the receiving location may still reveal factors that would make the location inappropriate to receive the proposed fill material. Nothing in this guidance relieves any party of the obligation to conduct such due diligence and appropriately consider and act on information thereby obtained.

[2] *See* Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil (May, 2002) http://www.mass.gov/eea/docs/dep/cleanup/laws/backtu.pdf

- **Sample the soils at the receiving location**.
  The sampling plan should include a sufficient number of samples taken at locations selected to provide an understanding of the concentrations of OHM present and the distribution of OHM throughout the receiving location. In order to provide data appropriate for the Similar Soils comparison, the soil at the receiving location should be analyzed for constituents that are likely to be present there (e.g., naturally occurring metals) as well as any OHM known or likely to be present in the soil brought from the disposal site. If a receiving location has been adequately and comprehensively characterized, that data may then be used for comparison to the OHM concentrations in any subsequent soil deliveries - additional sampling is not required.

- **Provide Technical Justification for an Alternative Approach**
  There may be situations for which a different combination of analytical and non-analytical information available for both the source and receiving locations is sufficient to conclude that the nature and concentrations of OHM in the soils are not significantly different. Guidance on recognizing such conditions and the level of documentation that would be necessary to support such a technical justification is beyond the scope of this guidance.

Once the concentrations of OHM in the soils are known (or assumed consistent with this guidance), the LSP must compare the concentrations of the source and receiving locations and determine whether the concentrations at the receiving location are "significantly lower" than those in the soil proposed to be relocated from the disposal site. This comparison may be conducted in several ways, including analyses with appropriate statistical power and confidence. MassDEP has also developed a *rule-of-thumb* comparison to simplify this determination, as described in Section IV.

IV. Determining whether soils at the receiving location are "significantly lower" using a simplified approach

The simplified comparison shall be made using the *maximum* values of the OHM concentrations in both the soil at the receiving location and the soil proposed to be disposed of or reused, using discrete (not composite) samples.

Use of the maximum values is appropriate for several reasons. First, the provisions of 310 CMR 40.0032(3) include comparisons to Reportable Concentrations, and notification is triggered by any single value (i.e., maximum value) exceeding the RC. Second, soil is by its nature heterogeneous, and the use of maximum values is a means of minimizing sampling costs while addressing the expected variability of results. Third, if natural background levels are assumed at the receiving location, the MassDEP published background concentrations are upper percentile levels that are only appropriately compared to similar (e.g., maximum) values of the soil data set.

Note also that when using the maximum reported concentrations for comparison purposes, the typical or average concentration will be lower. This is important to recognize if/when the question of the risk posed by the soil is raised. For example, the RCS-1 and the Method 1 S-1 standard for arsenic are both 20 mg/kg. The Reportable Concentration is applied as a not-to-be-exceeded value, triggering the need to report the release and investigate further. However the S-1 standard is applied as an average value, considering exposure over time. At a location where the highest arsenic value found is less than 20 mg/kg, the average concentration would be well below the Method 1 S-1 standard.

The maximum concentration in the soil at the receiving location may be less than that in the proposed disposed/reused soil by some amount and not be considered "significantly lower." The question is how much lower is "significantly lower"? In this guidance, MassDEP establishes a multiplying factor to be applied to the concentration in the soil at the receiving location. The multiplying factor varies depending upon the concentration in the soil at the receiving location, as shown in Table 1.

Table 1. Receiving Soil Concentration Multiplying Factors

If the concentration in soil at the receiving location for a given OHM is:	Then use a multiplying factor of:
< 10 mg/kg	10
10 mg/kg ≤ *x* <100 mg/kg	7.5
100 mg/kg ≤ *x* <1,000 mg/kg	5
≥ 1,000 mg/kg	2.5

EXAMPLE: The soil at a receiving location that is considered RCS-1 is appropriately sampled and the maximum concentration of silver is found to be 6 mg/kg. Using Table 1, the concentration of silver at the receiving location would not be considered "significantly lower" than *10 x 6 mg/kg = 60 mg/kg*. Since 60 mg/kg is less than the silver RCS-1 value of 100 mg/kg, soil containing a maximum concentration that is less than 60 mg/kg silver could be reused at this location.

EXAMPLE: The soil at a receiving location that is considered RCS-1 is assumed to be consistent with natural background. The MassDEP published natural background level for arsenic is 20 mg/kg. Using Table 1, the concentration of arsenic at the receiving location would not be considered "significantly lower" than *7.5 x 20 mg/kg = 150 mg/kg*. However, since 150 mg/kg is greater than the arsenic RCS-1 value of 20 mg/kg, only soil containing a maximum concentration that is less than 20 mg/kg arsenic could be reused at this location. [The managed soil must not create a notifiable condition at the receiving location, see Section III.C. above.]

> **EXAMPLE:** The soil at a receiving location that is considered RCS-2 is assumed to be consistent with natural background. The MassDEP published natural background level for benzo[a]anthracene is 2 mg/kg. Using Table 1, the concentration of benzo[a]anthracene at the receiving location would not be considered "significantly lower" than *10 x 2 mg/kg = 20 mg/kg*. Since 20 mg/kg is less than the benzo[a]anthracene RCS-2 value of 40 mg/kg, soil containing a maximum concentration that is less than 20 mg/kg benzo[a]anthracene could be reused at this location. [Note that due to the lower reportable concentration, RCS-1 receiving locations could only accept soil containing less than 7 mg/kg benzo[a]anthracene.]

The multiplying factors in Table 1 and the MassDEP published natural background levels can be used to establish concentrations of OHM in soil that would be acceptable for reuse at an RCS-1 receiving location, consistent with the requirements of 310 CMR 40.0032(3). Table 2 lists such concentrations. Note that soil that meets the criteria in Table 2 could be re-used at *any* location (RCS-1 or RCS-2). Similarly, Table 3 lists concentrations of OHM in soil that would be acceptable for reuse at an RCS-2 receiving location (but *not* RCS-1 locations).

If a chemical is not listed on these tables, then MassDEP has not established a natural background concentration[3]. This guidance is limited to the use of only MassDEP-published statewide background concentrations. Therefore an alternative approach, such as sampling the receiving location and comparing maximum reported concentrations, would be appropriate to meet the requirements of 310 CMR 40.0032(3).

[3] For example, MassDEP has not established natural background levels for PCBs, volatile organic compounds (VOCs) or petroleum-related constituents.

Table 2.
Limits to the Concentration of OHM In Soil for Re-Use
Assuming Natural Background Conditions at an RCS-1 Receiving Location
NOTE: THIS TABLE WILL BE REVISED IN THE FALL OF 2013 TO REFLECT RCS-1 REVISIONS

OIL OR HAZARDOUS MATERIAL	Concentration In "Natural" Soil mg/kg	Rule-of-Thumb Multiplier	Multiplied Value mg/kg	RCS-1 mg/kg	Limiting[1] Soil Concentration mg/kg	
ACENAPHTHENE	0.5	10	5	4	<	4
ACENAPHTHYLENE	0.5	10	5	1	<	1
ALUMINUM	10,000	2.5	25000		<	25000
ANTHRACENE	1	10	10	1000	<	10
ANTIMONY	1	10	10	20	<	10
ARSENIC	20	7.5	150	20	<	20
BARIUM	50	7.5	375	1000	<	375
BENZO(a)ANTHRACENE	2	10	20	7	<	7
BENZO(a)PYRENE	2	10	20	2	<	2
BENZO(b)FLUORANTHENE	2	10	20	7	<	7
BENZO(g,h,i)PERYLENE	1	10	10	1000	<	10
BENZO(k)FLUORANTHENE	1	10	10	70	<	10
BERYLLIUM	0.4	10	4	100	<	4
CADMIUM	2	10	20	2	<	2
CHROMIUM (TOTAL)	30	7.5	225	30	<	30
CHROMIUM(III)	30	7.5	225	1000	<	225
CHROMIUM(VI)	30	7.5	225	30	<	30
CHRYSENE	2	10	20	70	<	20
COBALT	4	10	40		<	40
COPPER	40	7.5	300		<	300
DIBENZO(a,h)ANTHRACENE	0.5	10	5	0.7	<	0.7
FLUORANTHENE	4	10	40	1000	<	40
FLUORENE	1	10	10	1000	<	10
INDENO(1,2,3-cd)PYRENE	1	10	10	7	<	7
IRON	20,000	2.5	50000		<	50000
LEAD	100	5	500	300	<	300
MAGNESIUM	5,000	2.5	12500		<	12500
MANGANESE	300	5	1500		<	1500
MERCURY	0.3	10	3	20	<	3
METHYLNAPHTHALENE, 2-	0.5	10	5	0.7	<	0.7
NAPHTHALENE	0.5	10	5	4	<	4
NICKEL	20	7.5	150	20	<	20
PHENANTHRENE	3	10	30	10	<	10
PYRENE	4	10	40	1000	<	40
SELENIUM	0.5	10	5	400	<	5
SILVER	0.6	10	6	100	<	6
THALLIUM	0.6	10	6	8	<	6
VANADIUM	30	7.5	225	600	<	225
ZINC	100	5	500	2500	<	500

[1] Concentration of OHM in soil must be LESS THAN (not equal or greater than) this value.

Table 3.
Limits to the Concentration of OHM In Soil for Re-Use
Assuming Natural Background Conditions at an RCS-2 Receiving Location
NOTE: THIS TABLE WILL BE REVISED IN THE FALL OF 2013 TO REFLECT RCS-2 REVISIONS

OIL OR HAZARDOUS MATERIAL	Concentration In "Natural" Soil mg/kg	Rule-of-Thumb Multiplier	Multiplied Value mg/kg	RCS-2 mg/kg	Limiting[1] Soil Concentration mg/kg	
ACENAPHTHENE	0.5	10	5	3000	<	5
ACENAPHTHYLENE	0.5	10	5	10	<	5
ALUMINUM	10,000	2.5	25000		<	25000
ANTHRACENE	1	10	10	3000	<	10
ANTIMONY	1	10	10	30	<	10
ARSENIC	20	7.5	150	20	<	20
BARIUM	50	7.5	375	3000	<	375
BENZO(a)ANTHRACENE	2	10	20	40	<	20
BENZO(a)PYRENE	2	10	20	4	<	4
BENZO(b)FLUORANTHENE	2	10	20	40	<	20
BENZO(g,h,i)PERYLENE	1	10	10	3000	<	10
BENZO(k)FLUORANTHENE	1	10	10	400	<	10
BERYLLIUM	0.4	10	4	200	<	4
CADMIUM	2	10	20	30	<	20
CHROMIUM (TOTAL)	30	7.5	225	200	<	200
CHROMIUM(III)	30	7.5	225	3000	<	225
CHROMIUM(VI)	30	7.5	225	200	<	200
CHRYSENE	2	10	20	400	<	20
COBALT	4	10	40		<	40
COPPER	40	7.5	300		<	300
DIBENZO(a,h)ANTHRACENE	0.5	10	5	4	<	4
FLUORANTHENE	4	10	40	3000	<	40
FLUORENE	1	10	10	3000	<	10
INDENO(1,2,3-cd)PYRENE	1	10	10	40	<	10
IRON	20,000	2.5	50000		<	50000
LEAD	100	5	500	300	<	300
MAGNESIUM	5,000	2.5	12500		<	12500
MANGANESE	300	5	1500		<	1500
MERCURY	0.3	10	3	30	<	3
METHYLNAPHTHALENE, 2-	0.5	10	5	80	<	5
NAPHTHALENE	0.5	10	5	40	<	5
NICKEL	20	7.5	150	700	<	150
PHENANTHRENE	3	10	30	1000	<	30
PYRENE	4	10	40	3000	<	40
SELENIUM	0.5	10	5	800	<	5
SILVER	0.6	10	6	200	<	6
THALLIUM	0.6	10	6	60	<	6
VANADIUM	30	7.5	225	1000	<	225
ZINC	100	5	500	3000	<	500

[1] Concentration of OHM in soil must be LESS THAN (not equal or greater than) this value.

V. Sampling Considerations

The soil proposed for disposal/re-use should be sampled at sufficient and adequately distributed locations so that the concentrations of the contaminants of concern in the soil are adequately characterized. This includes sampling for the purpose of MCP site assessment and sampling to characterize the soil in any given stockpile/shipment leaving the site. The factors listed below should be considered when developing and implementing such a sampling plan. Evaluation of release, source, and site specific conditions assist in developing the basis for the selection of field screening techniques, sampling methodologies, sampling frequencies, and the contaminants of concern (e.g., analytical parameters) used to characterize the soil. These include, but are not necessarily limited to the following:

- the type(s) and likely constituents known or suspected to be in the soil;
- current and former site uses, past incidents involving the spill or release of OHM, and past and present management practices of OHM at the site;
- the potential for the soil to contain listed hazardous waste or to be a characteristic hazardous waste;
- the presence or likelihood of any other OHM (e.g., chlorinated solvents, metals, polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs) , halogenated volatile organic compounds (VOCs));
- visual/olfactory observations, field screening, analytical data, and/or in-situ pre-characterization data;
- soil matrix type - naturally occurring soil or fill/soil mixtures (e.g., homogeneous or heterogeneous soil conditions);
- the identification and segregation of discrete "hot spots";
- the concentration variability in the soil;
- the volume of soil;
- the current and likely future exposure potential at the receiving location, including the potential for sensitive receptors, such as young children, to contact the soil (for example, more extensive sampling of the stockpiles would be warranted for soil slated to be moved to a residential setting than for soil being moved to a secure, low-exposure potential regulated receiving facility); and
- any sampling requirements stipulated by the receiving location.

The assessment of the soil, including the nature and concentrations of OHM therein, is a component of the MCP site assessment and therefore must meet all applicable performance standards, including those for environmental sample collection, analysis and data usability[4]. The assessment should address the precision, accuracy, completeness, representativeness, and comparability of the sampling and analytical results used to determine whether the soil

[4] Additional guidance on data usability is available in Policy #WSC-07-350, MCP Representativeness Evaluations and Data Usability Assessments. http://www.mass.gov/eea/docs/dep/cleanup/laws/07-350.pdf

stockpiles meet the Similar Soils Provision requirements. The representativeness of any site assessment sampling data if used to characterize contaminant concentrations in soil to be moved and reused offsite should be carefully evaluated. Additional guidance on soil sampling considerations is available from U.S. EPA and other state environmental agencies.[5]

VI. Segregation and Management of Soils of Different Known Quality

Soil containing concentrations of OHM equal to or greater than the values listed in Table 3 cannot be managed using the streamlined approach described in this guidance. Such soil must be managed in a manner consistent with its regulatory classification, which may include management as a hazardous waste, as a remediation waste, or under a case-specific Similar Soils determination.

Segregation of soil of different quality should occur based upon *in-situ* pre-characterization sampling results. Stockpiles of soil are mixtures that would require more extensive sampling to document the effectiveness of any attempted post-excavation segregation.

The known presence of soil that exceeds the Table 3 concentrations and the subsequent segregation of soil is one factor that would indicate the need for more frequent sampling (at least in that area of soil excavation) as described in Section V.

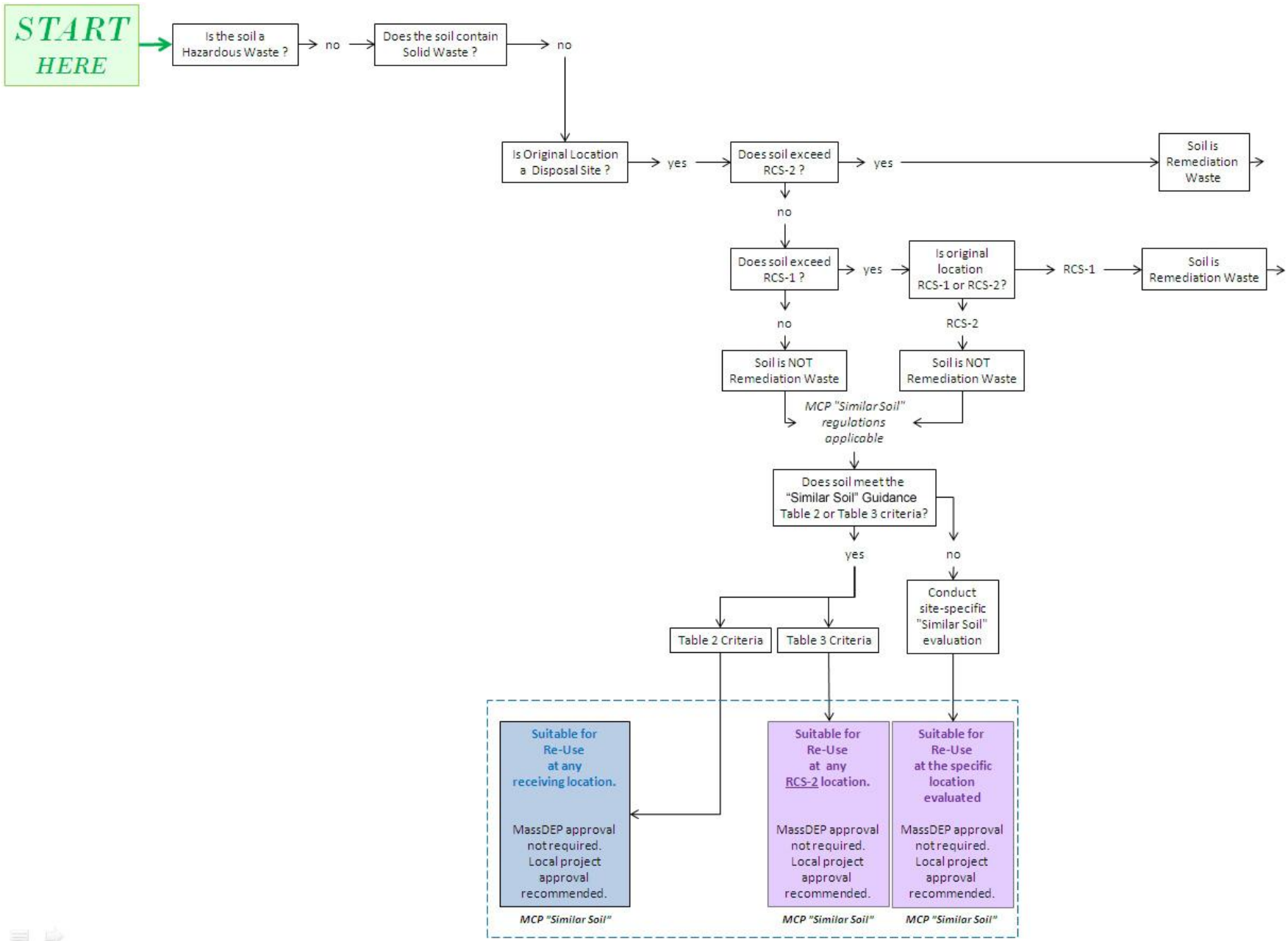
[5] Note that the guidance below are not specific to MGL Chapter 21E disposal sites and may not reflect MCP-specific considerations to determine the suitability of soils for offsite transport and use, such as for residential and other S-1 locations.

NJDEP. 2011. Alternative and Clean Fill Guidance for SRP Sites.
New Jersey Department of Environmental Protection Site Remediation Program
http://www.state.nj.us/dep/srp/guidance/srra/fill_protocol.pdf

USEPA. 1992. Supplemental Guidance to RAGS: Calculating the Concentration Term.
Office of Solid Waste and Emergency Response (OSWER), Washington, DC
http://www.epa.gov/oswer/riskassessment/pdf/1992_0622_concentrationterm.pdf

USEPA. 1995. Superfund Program Representative Sampling Guidance Volume 1: Soil.
OSWER. Washington, DC.
(Note that guidance for determining the number of samples for statistical analysis is addressed in Section 5.4.1).
http://www.epa.gov/tio/download/char/sf_rep_samp_guid_soil.pdf

Attachment 1 – Similar Soil Flowchart



Attachment 2

Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil (May, 2002)

Massachusetts Department of ENVIRONMENTAL PROTECTION

t e c h n i c a l u p d a t e

Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil

Updates: Section 2.3 *Guidance for Disposal Site Risk Characterization – In Support of the Massachusetts Contingency Plan* (1992)

Discussion

Polycyclic Aromatic Hydrocarbons ("PAHs") are ubiquitous and consistently present in the environment and are typically formed during the incomplete burning of organic material including wood, coal, oil, gasoline and garbage. PAHs are also found in crude oil, coal tar, creosote and asphalt. Historically, PAHs have been associated with human activities such as cooking, heating homes and industries and fuel for operating automobiles, although low levels of PAHs are also present in the environment from natural sources, such as forest fires. Their presence in the environment at higher concentrations is an artifact of habitation and is due to the widespread practice of emptying fireplaces, stoves, boilers, garbage, etc. in rural and urban areas over the past several hundred years. As a result, it is very common to detect "background" levels of PAHs in soils. Metals are both naturally occurring and found in man-made materials (such as paint, fuel, fertilizers and pesticides) widely distributed in the environment. Naturally occurring metals present in wood and coal are often found concentrated in ash residue.

DEP has obtained background data from various sources documenting the concentrations of PAHs and metals in soil affected by human activities, particularly soil associated with wood ash and coal ash. These levels are representative of typical concentrations found in areas with fill material, *not* pristine conditions. DEP has also compiled background soil data for metals that are representative of undisturbed, natural conditions.

The identification of generic values for PAHs and metals in soil is intended to streamline the risk characterization process (310 CMR 40.0900) and determination of applicable Response Action Outcome Category (310 CMR 40.1000). Nothing in this Technical Update obviates the need to establish location-specific background conditions for other purposes, such as compliance with the anti-degradation provisions of the Massachusetts Contingency Plan ("MCP") described at 310 CMR 40.0032(3).

Definition of Background (310 CMR 40.0006)

Background means those levels of oil and hazardous material that would exist in the absence of the disposal site of concern which are either:

(a) ubiquitous and consistently present in the environment at and in the vicinity of the disposal site of concern; and attributable to geologic or ecological conditions, or atmospheric deposition of industrial process or engine emissions;
(b) attributable to coal ash or wood ash associated with fill material;
(c) releases to groundwater from a public water supply system; or
(d) petroleum residues that are incidental to the normal operation of motor vehicles.

Basis of the Background Levels for Soil

The background levels were selected following an analysis of several datasets, including:

- Data (30-140 samples) collected to represent background at c.21E sites located in non-urban areas, gathered from a review of DEP files,
- Site-specific background samples generated for locations in Worcester (68 samples) and Watertown (17 samples),
- Data (750-1,000 samples) collected by Mass Highway Department as part of the Central Artery/Tunnel (CA/T) project and presented in a draft document *Background Soil Contaminant Assessment* (CDM, April 1996),
- Data (590 natural soil samples from depths of 10 to 70 feet) collected by Haley & Aldrich, Inc. in the Boston Area
- Preliminary data compiled by the Massachusetts Licensed Site professional Association from background data submitted by its members,
- Published data (62 samples) from ENSR, Inc. from 3 New England locations, and
- Generic background data published by the Agency for Toxic Substances and Disease Registry (ATSDR).

There is not one concentration of a chemical, of course, which can correctly be labeled ***the*** background level. Hundreds of years of human activities have only broadened the naturally occurring range of concentrations reported as "background", and this range is best thought of as a statistical distribution. In the evaluation of environmental contamination, we often select point values from the range of background levels, and consider these to be representative of background. The use of such point-value "background" levels is essentially a short-cut method that allows consideration of background in the absence of site-specific information. The intent of DEP policy is to protect public health while minimizing the routine site-specific determinations at sites in the statewide cleanup program.

"Natural" Soil

- Generally, the 90th percentile value from the MA DEP 1995 dataset was the point-value identified as background.
- In the absence of data in the MA DEP 1995 dataset, a lower percentile value from the CDM 1996 dataset was chosen as background.

Soil Containing Fill Material

- Generally, the 90th percentile value from the CDM 1996 dataset was point-value identified as background.
- In the absence of data in the CDM 1996 dataset, the 90th percentile value from the "natural" soil (MA DEP, 1995) dataset was chosen as background.

Applicability of the Values Listed in Table 1

Table 1 presents two lists of background concentrations: one for use with natural soils, and the second for use with soils containing either coal ash or wood ash associated with fill material, or other material consistent with the regulatory definition of background. The list for use with natural soils may be compared to site soil concentrations with no site-specific justification. The use of the list for soil containing fill material must be accompanied by documentation that the soil at the site does, in fact, contain coal ash or wood ash associated with fill material (or other material consistent with the regulatory definition of background). Such documentation may include information about the site history, soil strata, physical evidence or visual observations (including microscopic).

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Elevated chemical concentrations and/or and urban setting are not, *per se*, sufficient evidence to justify use of the higher background levels.

Comparison of Site Concentrations to the Background Levels for Soil

Section 2.3 of the DEP's *Guidance for Disposal Site Risk Characterization – In Support of the Massachusetts Contingency Plan* (1995) describes the use of DEP-published generic background values. If the site investigation indicates the presence of fill material in the soil, and *all* reported concentrations of an oil or hazardous material ("OHM") fall below the applicable value published in Table 1, then it may concluded that the OHM is present at background concentrations. In other words, the values published in Table 1 are to be compared to the maximum reported concentration at the site. This Technical Update does not modify or change this comparison.

Table 1 lists background levels for "natural" soil and for soil containing coal ash and wood ash associated with fill material. A detailed summary of the data is attached in Appendix A. The applicability of these background concentrations to a site should be determined based upon the presence or absence of fill material containing coal ash or wood ash. If all contaminant concentrations are found to be equal to or less than the applicable background concentrations, a Class A-1 Response Action Outcome may be an option at the site, and no Activity and Use Limitation is required.

Background Concentrations Different Than The MADEP-Published Values

Appendix A describes the wide ranges seen in the distributions of background concentrations. MADEP's choice of point values within these ranges balances the need to eliminate background chemicals from the risk assessment with the need to retain for evaluation those chemicals whose presence is related to the disposal practices at the site.

It is inevitable that at some sites the use of the values listed in Table 1 will incorrectly require the assessment of some "true" background concentrations of OHM at the high end of the background range. Conversely, some chemicals that *are* related to the disposal practices at a site (and are not background) will be screened out of the risk assessment by the use of the Table 1 concentrations. The goal is to minimize **both** kinds of error.

In many cases, additional information about the location of the site, the nature of the soils or the known or suspected disposal practices may be used to justify the application of different literature values or site-specific background information. DEP's adoption of the generic, statewide values presented in this Technical Update does not negate the validity of site-specific background information, when such information is available and of appropriate data quality. The level of effort necessary for such a justification will depend on the specific circumstances. For example, such a justification would be straightforward for elevated arsenic concentrations in soil at a gasoline-release site in an area of the state known to have geological formations rich in arsenic. The level of effort would be significantly higher at a tannery site in the same area due to the facility's historic use of arsenic. Similarly, the presence of elevated chromium or barium concentrations in marine clay deposits could generally be attributable to natural background absent known or suspected sources of the chemical at the site.

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Minimizing Exposure to Soils Containing Elevated Background Material and/or Material Exempt from M.G.L. c.21E

As discussed in this Technical Update, M.G.L. Chapter 21E and the Massachusetts Contingency Plan (the statute and regulations) do not require remediation of chemicals present at levels consistent with background, even if such concentrations would otherwise pose a significant risk of harm to health, safety, public welfare or the environment. The statute also exempts several other environmental conditions (such as lead from lead paint or gasoline and pesticides applied according to their label) that could pose a Significant Risk.

While such conditions are not subject to regulation by DEP, the Department encourages parties to mitigate potential exposures whenever possible. Such mitigation measures could include:

- providing clean soil (down to a depth of 3 feet) in residential settings, and
- providing clean corridors for utility lines.

For Further Information

For further information about this Technical Update, please contact Paul W. Locke, Massachusetts Department of Environmental Protection, One Winter Street, Boston, MA 02108, telephone: (617) 556-1052, email: Paul.Locke@state.ma.us.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Polycyclic Aromatic Hydrocarbons (PAHs) (Update) August, 1995.

Bradley, L.J.N., Magee, B.H., and Allen, S.L. 1994. Background Levels of Polycyclic Aromatic Hydrocarbons (PAH) and Selected Metals in New England Urban Soils. Journal of Soil Contamination, 3(4):349-361

Camp Dresser & McKee (CDM). 1995. CA/T ROW Background Soil Contaminant Assessment. Prepared for the Massachusetts Highway Department, Central Artery/Tunnel Project.

Haley & Aldrich, Inc. 2001. Boston Background Soil Quality Data, May 22, 2001. Memorandum to Brian Moran, MA DEP Bureau of Waste Site Cleanup.

Licensed Site Professional Association (LSPA) 2001. Summary of Selected Results, LSPA Anthropogenic Fill Soils Project, April 2001. Personal Communication.

Massachusetts Department of Environmental Protection (MA DEP). 1995. Guidance for Disposal Site Risk Characterization – In Support of the Massachusetts Contingency Plan. BWSC/ORS-95-141.

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Table 1.

MADEP Identified Background Levels in Soil

OIL OR HAZARDOUS MATERIAL	Concentration in "Natural" Soil mg/kg	Concentration in Soil Containing Coal Ash or Wood Ash Associated With Fill Material mg/kg
ACENAPHTHENE[2]	0.5	2
ACENAPHTHYLENE[2]	0.5	1
ANTHRACENE[2]	1	4
ALUMINUM[1]	10,000	10,000
ANTIMONY	1	7
ARSENIC	20	20
BARIUM[1]	50	50
BENZO(a)ANTHRACENE[2]	2	9
BENZO(a)PYRENE[2]	2	7
BENZO(b)FLUORANTHENE[2]	2	8
BENZO(g,h,i)PERYLENE[2]	1	3
BENZO(k)FLUORANTHENE[2]	1	4
BERYLLIUM	0.4	0.9
CADMIUM	2	3
CHROMIUM (TOTAL)	30	40
CHROMIUM(III)	30	40
CHROMIUM(VI)	30	40
CHRYSENE[2]	2	7
COBALT[1]	4	4
COPPER	40	200
DIBENZO(a,h)ANTHRACENE[2]	0.5	1
FLUORANTHENE[2]	4	10
FLUORENE[2]	1	2
INDENO(1,2,3-cd)PYRENE[2]	1	3
IRON[1]	20,000	20,000
LEAD	100	600
MAGNESIUM[1]	5,000	5,000
MANGANESE[1]	300	300
MERCURY	0.3	1
METHYLNAPHTHALENE, 2-[2]	0.5	1
NAPHTHALENE[2]	0.5	1
NICKEL	20	30
PHENANTHRENE[2]	3	20
PYRENE[2]	4	20
SELENIUM	0.5	1
SILVER	0.6	5
THALLIUM	0.6	5
VANADIUM[1]	30	30
ZINC	100	300

(Values rounded to one significant figure.)

[1] In the absence of fill-specific data, the "natural" soil value has been adopted.

[2] In the absence of data specific to "natural" soil, a lower percentile value from the fill data set has been adopted.

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Levels of PAHs and Metals in Soil from Various Datasets

Appendix A - Detailed Data Summary

	Number of Samples	Geometric Mean or Median mg/kg	Minimum mg/kg	50th mg/kg	90th mg/kg	95th mg/kg	Maximum mg/kg
			<---------- PERCENTILES ---------->				
Total PAHs							
CA/T Project	873	2.7	0.08	2.6	92	230	3000
ENSR - Urban Soils	62	10.97	2.292				167
Total Carcingenic PAHs							
CA/T Project	873	1.5	0.022	1.1	42	95	1200
ENSR - Urban Soils	62	4.86	0.68				78
Total Noncarcinogenic PAHs							
CA/T Project	873	1.9	0.08	1.6	54	140	1900
ENSR - Urban Soils	62	6.11	1.612				89
Acenaphthene							
CA/T Project	868	0.18	0.024	0.18	1.9	4.1	42
Med City/Mill Brook	67	NC	ND (64)	NC	NC	NC	1.7
ENSR - Urban Soils	62	0.128	ND (32)				3.4
Acenaphthylene							
CA/T Project	869	0.17	0.037	0.17	1	1.9	10
Med City/Mill Brook	67	NC	ND (65)	NC	NC	NC	0.76
ENSR - Urban Soils	62	0.133	ND (38)				1.1
Anthracene							
CA/T Project	872	0.2	0.033	0.2	3.8	10	130
Med City/Mill Brook	68	NC	ND (52)	NC	0.592	1.2	3.4
ENSR - Urban Soils	62	0.184	ND (8)				5.7
Benzo[a]pyrene							
CA/T Project	873	0.3	0.031	0.3	7.4	17	230
LSPA Project	489	0.44	ND (220)	0.44	15.3	NC	222
Watertown	17	0.95	0.6	NC	3.39	4.77	6.08
Med City/Mill Brook	67	NC	ND (43)	NC	2.02	3.3	9.7
ENSR - Urban Soils	62	0.686	ND (5)				13
ATSDR Range:			0.165				0.22
Benzo[a]anthracene							
CA/T Project	872	0.33	0.045	0.33	8.5	19	250
LSPA Project	490	0.563	ND (206)	0.563	17.6	NC	796
Watertown	17	0.411	0.021	0.48	2.52	6.04	6.05
Med City/Mill Brook	68	NC	ND (38)	NC	2.39	3.8	15
ENSR - Urban Soils	62	0.672	ND (4)				15
ATSDR Range:			0.169				59
Benzo[b]fluoranthene							
CA/T Project	873	0.68	0.045	0.4	8.4	18	270
LSPA Project	486	NC	ND (258)	NC	11	NC	250
Watertown	17	1.4	0.6	0.6	6.78	6.79	7.08
ENSR - Urban Soil	62	0.722	ND (7)				12
ATSDR Range:			15				62

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Appendix A - Detailed Data Summary

	Number of Samples	Geometric Mean or Median mg/kg	Minimum mg/kg	50th mg/kg	90th mg/kg	95th mg/kg	Maximum mg/kg
			<---------- PERCENTILES ---------->				
Benzo[g,h,i]perylene							
CA/T Project	871	0.2	0.045	0.2	3.1	7.7	77
Med City/Mill Brook	67	NC	ND (52)	NC	1.2	1.41	5.2
ENSR - Urban Soil	62	0.461	ND (26)				5.9
ATSDR Range:			0.9				47
Benzo[k]fluoranthene							
CA/T Project	869	0.21	0.045	0.21	4	9.7	150
LSPA Project	475	NC	ND (289)	NC	11.4	NC	110
Watertown	17	0.502	0.065	0.406	3.35	4.47	5.13
ENSR - Urban Soil	62	0.834	ND (3)				25
ATSDR Range:			0.3				26
Chrysene							
CA/T Project	873	0.35	0.022	0.35	7.3	18	240
LSPA Project	490	0.59	ND (204)	0.59	20.3	NC	420
Watertown	17	0.32	0.016	0.404	4.55	5.06	6.6
Med City/Mill Brook	68	NC	ND (42)	NC	2.1	3.6	14
ENSR - Urban Soil	62	0.844	ND (2)				21
ATSDR Range:			0.251				0.64
Dibenzo[a,h]anthracene							
CA/T Project	866	0.17	0.045	0.17	1.1	2.1	39
Watertown	17	0.195	0.155	NC	0.494	0.604	0.64
Med City/Mill Brook	68	NC	ND (65)	NC	NC	NC	1.6
ENSR - Urban Soils	62	0.245	ND (30)				2.9
Fluoranthene							
CA/T Project	873	0.89	0.035	0.61	14	33	490
Med City/Mill Brook	68	NC	ND (32)	0.376	4.2	11	40
ENSR - Urban Soils	62	1.38	ND (2)				39
ATSDR Range:			0.2				166
Fluorene							
CA/T Project	873	0.18	0.028	0.18	2.3	5.5	79
Med City/Mill Brook	68	NC	ND (65)	NC	NC	NC	2
ENSR - Urban Soils	62	0.141	ND (27)				3.3
Indeno[1,2,3-cd]pyrene							
CA/T Project	871	0.2	0.022	0.2	2.8	7	100
LSPA Project	475	NC	ND (304)	NC	6.3	NC	130
Watertown	17	1.752	1.2	NC	5.64	6.2	7.2
Med City/Mill Brook	68	NC	ND (50)	NC	1.5	2	6
ENSR - Urban Soil	62	0.532	ND (19)				6
ATSDR Range:			8				61
2-Methylnaphthalene							
CA/T Project	789	0.15	0.03	0.15	0.96	2.2	13
Med City/Mill Brook	68		ND (67)	NC	NC	NC	0.77
ENSR - Urban Soil	62	0.121	ND (43)				0.64

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Appendix A - Detailed Data Summary

	Number of Samples	Geometric Mean or Median mg/kg	Minimum mg/kg	50th mg/kg	90th mg/kg	95th mg/kg	Maximum mg/kg
			<---------- PERCENTILES ---------->				
Naphthalene							
CA/T Project	867	0.17	0.016	0.17	1.4	3	28
Med City/Mill Brook	68	NC	ND (65)	NC	NC	NC	1.9
ENSR - Urban Soils	62	0.0917	ND (27)				0.66
Phenanthrene							
CA/T Project	873	0.8	0.029	0.47	15	38	480
Med City/Mill Brook	68	NC	ND (38)	NC	2.7	5.6	16
ENSR - Urban Soils	62	0.788	ND (1)				36
Pyrene							
CA/T Project	873	0.89	0.034	0.61	16	35	440
Med City/Mill Brook	68	NC	ND (32)	0.343	4.29	9	30
ENSR - Urban Soil	62	1.54	ND (1)				11
ATSDR Range:			0.145				147
Aluminum							
DEP 1995	30	5536	387	7800	13000	16000	24000
Antimony							
DEP 1995	90	0.2	ND (0.002)	0.34	1.4	4.8	22
CA/T Project	746	NC	0.25	1	7	12	160
Arsenic							
DEP 1995	139	4.7	ND (0.1)	4.8	16.7	24.5	99
CA/T Project	754	5.3	0.25	5.4	14	21	99
H&A 2001	589	5.5	ND	5.57	11	12.9	23
Barium							
DEP 1995	64	15	0.42	15.7	45.2	52.8	104
H&A 2001	490	35	ND	35.7	80.9	89.3	680
Beryllium							
DEP 1995	103	0.21	0.03	0.23	0.39	0.53	1.6
CA/T Project	746	0.5	0.03	0.5	0.88	2	7.5
H&A 2001	22	0.5	ND	0.63	1.15	1.2	1.3
Cadmium							
DEP 1995	127	0.43	ND (0.01)	0.29	2.06	3.4	5.9
CA/T Project	756	0.5	0.1	0.5	3	5	25
H&A 2001	572	1.8	ND	1.26	1.63	1.63	3
Chromium							
DEP 1995	147	10.3	0.02	10.6	28.6	38.8	105
CA/T Project	756	13	1	15	39	50	530
H&A 2001	589	22	ND	22	43.9	49.6	94
Cobalt							
DEP 1995	10	0.8	ND (0.5)	NC	4.4	4.5	4.7
Copper							
DEP 1995	103	7.7	ND (0.5)	7.3	37.7	56.1	160
CA/T Project	742	34	1	30	170	320	5300
H&A 2001	22	26	6	27	47.5	64.5	130

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Appendix A - Detailed Data Summary

		Number of Samples	Geometric Mean or Median mg/kg	Minimum mg/kg	50th mg/kg	90th mg/kg	95th mg/kg	Maximum mg/kg
				<---------- PERCENTILES ---------->				
Iron								
	DEP 1995	30	6031	444	7200	17000	22500	50000
Lead								
	DEP 1995	141	19.5	1	19.1	98.7	158	326
	CA/T Project	850	51	0.05	53	570	1100	11000
	LSPA Project	457	83	ND (5)	83	640	NC	10600
	H&A 2001	583	15	ND	24.4	78.9	112	300
Magnesium								
	DEP 1995	30	1028	ND (250)	1300	4900	6700	11000
Manganese								
	DEP 1995	30	81.5	ND (3)	110	300	365	460
Mercury								
	DEP 1995	107	0.043	ND (0.0002)	0.066	0.28	0.43	1.4
	CA/T Project	785	0.15	0.001	0.15	1.4	2.6	23
	H&A 2001	583	0.2	ND	0.19	0.74	1.1	2.5
Nickel								
	DEP 1995	103	4.6	ND (0.5)	5.1	16.6	22.7	48
	CA/T Project	740	14	1	14	31	41	220
	H&A 2001	22	34.5	5	35	67.5	70	101
Selenium								
	DEP 1995	93	0.1	ND (0.0005)	0.17	0.5	1	4.6
	CA/T Project	756	0.5	0.1	0.5	1	2.1	57
	H&A 2001	426	0.84	ND	0.74	1.36	1.58	2.8
Silver								
	DEP 1995	117	0.09	ND (0.003)	0.07	0.58	0.91	82
	CA/T Project	756	1	0.19	1	5	7.3	81
	H&A 2001	335	0.64	ND	NC	NC	NC	0.64
Thallium								
	DEP 1995	71	0.1	ND (0.005)	NC	0.6	1.65	5
	CA/T Project	734	NC	0.035	1	5	5	50
Vanadium								
	DEP 1995	30	7.6	ND (1)	10.3	28.5	38.5	46.6
Zinc								
	DEP 1995	112	29.3	3.52	27.7	116.4	131.2	190
	CA/T Project	746	84	5.8	73	340	590	5000
	H&A 2001	22	67	15	58.5	103	106	120

Attachment 3

Century Mill Soil Acceptance Criteria Table 1 (Revised)

TABLE 1

Analyte	Century Mills Acceptance Criteria (revised 5/5/2014)
GC/MS SEMI VOC/PAHs BY 8270D (mg/kg)	
2-Methylnaphthalene	<0.7
Acenaphthene	<4
Acenaphthylene	<1
Anthracene	<10
Benzo[a]anthracene	<7
Benzo[a]pyrene	<2
Benzo[b]fluoranthene	<7
Benzo[g,h,i]perylene	<10
Benzo[k]fluoranthene	<10
Chrysene	<20
Dibenz(a,h)anthracene	<0.7
Fluoranthene	<40
Fluorene	<10
Indeno[1,2,3-cd]pyrene	<7
Naphthalene	<4
Phenanthrene	<10
Pyrene	<40
GC/MS VOA BY 8260C (mg/kg)	
ALL VOCs	not detectable
GC SEMI VOA BY 8100 Modified	
TPH (C9-C36)	<500
PCBs BY 8082A (mg/kg)	
PCBs	<0.1
Pesticides BY 8081B (mg/kg)	ND
Herbicides BY 8151A (mg/kg)	ND
METALS BY 6010C (mg/kg)	
Arsenic	<20
Barium	<375
Cadmium	<20
Chromium (III)	<225
Chromium (VI)	<100
Chromium (Total)	<225
Lead	<200
Mercury	<3
Selenium	<5
Silver	<6

TABLE 1

Analyte	Century Mills Acceptance Criteria (revised 5/5/2014)
OTHER METALS (mg/kg)	
ALUMINUM	<25000
ANTIMONY	<10
BERYLLIUM	<4
COBALT	<40
COPPER	<300
IRON	<50000
MAGNESIUM	<12500
MANGANESE	<1500
NICKEL	<150
THALLIUM	<6
VANADIUM	<225
ZINC	<500
TOXICITY CHARACTERISTIC LEACHING PROCEDURE LEAD (mg/l)	
TCLP LEAD	<5
GENERAL CHEMISTRY BY SM 2510B (umhos/cm)	
Specific Conductance	<2000
pH (S.U.)	5.0-9
REACTIVE CN (mg/kg)	non reactive
REACTIVE SULFIDE (mg/kg)	non reactive
FLASHPOINT (degree F)	absent
IGNITABILITY (degree F)	absent

Samples should be collected at a frequency of one per 500 cy

Samples should be screened with a PID. Anything greater than 2 ppmV is not acceptable