

White Paper on the Evaluation of Source Materials at SRS Waste Units

Introduction

The concept of principal threat waste and low level threat waste as developed by the U.S. Environmental Protection Agency (EPA) in the National Contingency Plan (NCP) (40 CFR 300.430(a)(1)(iii)) is to be applied on a site-specific basis when characterizing source material. Source materials are those materials that include or contain hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or that act as a source for direct exposure. (EPA, 1991) Source characterizations are necessary to determine whether the source(s) can be designated as principal threat source material (PTSM), low-level threat source material (LLTSM), or non-hazardous materials. The NCP expectations for addressing PTSM and LLTSM are to:

- Use treatment to address the principal threats posed by a unit, wherever practicable
- Use engineering controls (i.e. containment) for wastes that pose a relatively low long-term threat or where treatment is impracticable
- Use a combination of methods where appropriate
- Use institutional controls to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure

Source Material Evaluation Process

The determination of whether the source materials present at a unit would be classified as PTSM, LLTSM, or non-hazardous material is based principally on EPA, 1991. In this guidance, the US EPA defines principal threat wastes as those materials that have a high toxicity or mobility and cannot be reliably contained or present significant risk to human health or the environment). They include liquids and other highly mobile materials (e.g., materials that are released from surface soil due to volatilization, leaching, or surface runoff) or materials having high concentrations of toxic compounds. "Low level" threat

wastes are materials that can be reliably contained and present a low risk to human health and the environment in the event of a release. These include materials that exhibit low toxicity, low mobility, or are near health-based levels. No “threshold level” of toxicity/risk has been established to equate to “principal threat. However, treatment alternatives for source materials should generally be evaluated where the combined toxicity and mobility pose a potential risk of 10^{-3} or greater. Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of a release. They include source materials that exhibit low toxicity, low mobility in the environment, or are near health-based levels.

Based on the EPA guidance presented above, a process has been developed to evaluate source materials, including criteria for classification. This process includes both a qualitative and quantitative assessment of the sources and associated impacted media. Figure 1 is a flowchart presenting the process and Figure 2 is a schematic figure that highlights the difference between PTSM and LLTSM.

Evaluation Steps

The first step is a qualitative assessment of the source material(s) to determine if they should be considered PTSM. These source materials would include containerized liquid wastes (e.g. drums) or non-aqueous phase liquids (NAPL) (e.g. perched dense NAPLs in the vadose zone), and highly toxic solid wastes such as PCB transformers or ballast and batteries.

The second step is to evaluate whether highly contaminated soils/sediment exist (e.g. the first few of feet of sediments in the reactor seepage basins) can be considered PTSM. A simple quantitative assessment evaluating both the toxicity and mobility of the source is used.

A source term concentration is established for all the unit-specific constituents (USC) identified. The samples collected from within the source material area are considered the

source group samples. Summary statistics (i.e., the mean, the 95 percent upper confidence limit on the mean [95% UCL], and the maximum) are compiled for each USC associated with each source group. The source term concentration used is an average, because the concentration is intended to represent a discernable source. Thus, the evaluation would avoid a bias based on a single highly elevated value, which would not be representative of the overall source. Therefore, the 95% UCL for the constituent of interest is used. In cases where the 95% UCL exceeded the maximum detected value for the source, the average detected value for that constituent is used.

The toxicity aspect of the source material evaluation considers both the potential risk from exposure to carcinogenic substances and the adverse health effects from noncarcinogens to human receptors exposed to unit-related constituents. Because the most likely probable future land use scenario for the site is industrial, the toxicity assessment of the source material is based on the potential exposure of an on-unit industrial worker. The most current US EPA Region III risk-based concentrations (RBC) for industrial scenario exposure to soil were used to develop the PTSM threshold criteria for carcinogens and noncarcinogens. For radionuclides, RBAs are used. If a RBC was not available, a surrogate value was used. For human health essential nutrients (calcium, chloride, magnesium, potassium, and sodium), there are no defined health-based limits, and these were excluded from the screening process. For lead (no RBC) and PCBs, the threshold criteria were based on US EPA guidance and Toxic Substances Control Act (TSCA) regulations, respectively

The source material is classified as PTSM if the source term concentration exceeds one of the following toxicity threshold criteria:

- Lead concentrations greater than 4,000 mg/kg (10 times the US EPA action level for lead. [EPA, 1994]) Alternatively, EPA 1994 states that the TSCA Section 403 identifies ranges over which various types of responses are appropriate. In the range of 400-5000 ppm, limited interim controls are recommended; while above 5000 ppm, soil abatement (treatment/removal) is recommended. Thus, 5,000 mg/kg may be a more substantiated value to use for the threshold criterion.

- PCB concentrations greater than 50 mg/kg (TSCA threshold for regulating contaminated soils as PCB waste)
- Total carcinogens greater than 10^{-3} risk
- Noncarcinogens HQ greater than 100, which is based on a three order of magnitude concentration increase from the screening level (HQ=0.1), the same as the three order of magnitude increase for carcinogens (10^{-6} to 10^{-3}).

To account for simultaneous exposure to multiple carcinogens, the incremental risks for each individual chemical carcinogen are summed for each source area to obtain the cumulative PTSM index value. Cancer risks are normalized by taking the source term concentration for a constituent and dividing it by the PTSM threshold criteria. If the cumulative PTSM index value is greater than 1, the source material is defined as PTSM.

The mobility aspect of the source material evaluation considers the potential impact of source material constituents on groundwater. Constituents evaluated for the mobility aspect of the PTSM assessment are selected from the list of contaminant migration constituents of concern (CM COCs) identified in Chapter 6.0 and assessed independently for each exposure group. The CM COCs are evaluated for travel time to groundwater. Based on the modeling results, if the predicted travel time to groundwater is less than 10 years, and the predicted groundwater concentration for that CM COC exceeds the maximum contaminant levels (MCLs) or RBCs, then the soil source material is identified as PTSM. The source is also considered PTSM if the CM COC is already present in groundwater above MCLs and is unit-related.

The final step is to evaluate whether the source, if not determined to be PTSM, is LLTSM. This is determined simply by reviewing if there are any unit-related COCs present in the media that is in direct contact with the source. If there are any human health, ecological, or contaminant migration COCs present, then the associated source is considered LLTSM. If no COCs are present, then the source is considered non-hazardous, and no action for the source will be required.

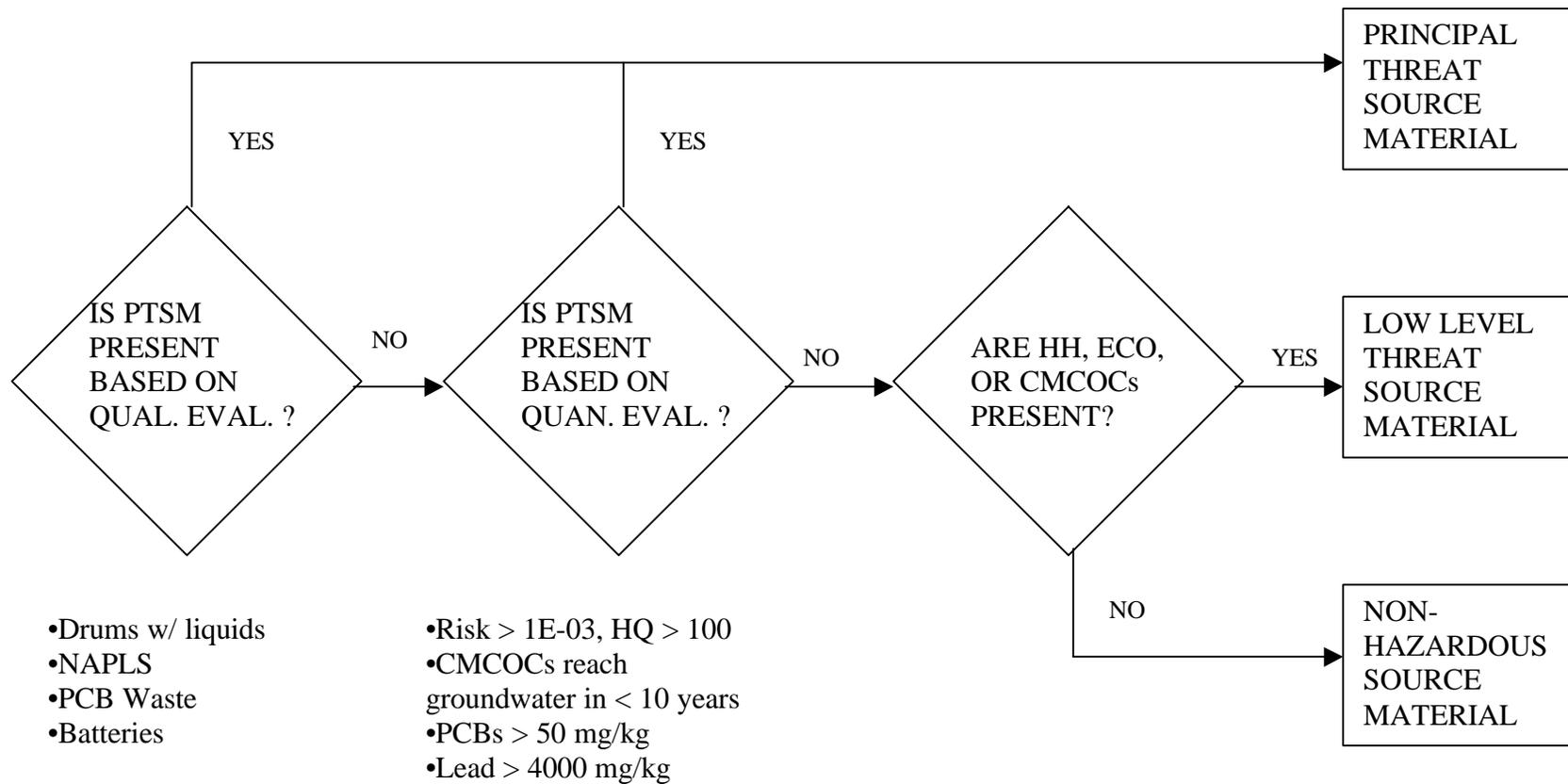
Remedial Alternatives Expectations

For those source materials that are considered to be PTSM, treatment and off-site disposal remedial alternatives will be emphasized. The opportunity for taking early action on these source materials will also be considered. For those source materials that are considered to be LLTSM, alternatives involving engineering controls and institutional controls will be emphasized. Due to the differences in the conceptual site models for many of the heterogeneous “landfill-type” units at SRS, it is recommended that the alternatives for each unit be evaluated on a unit-specific basis, rather than using a presumptive remedy approach.

References

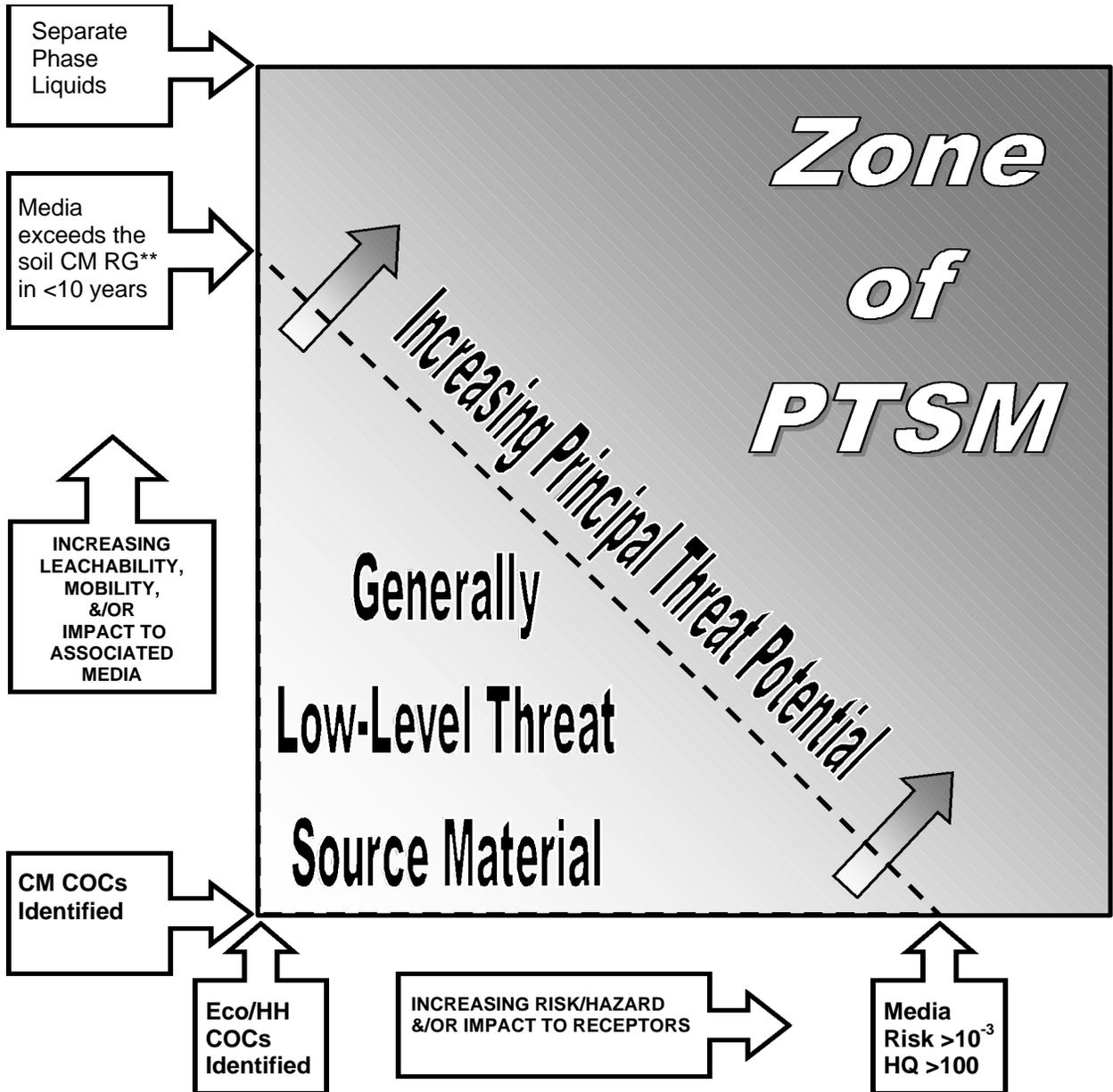
U.S. Environmental Protection Agency, 1991. A Guide to Principal Threat and Low Level Threat Wastes. OSWER Superfund Publication 9380.3-06FS. November 1991.

Source Material Evaluation Process



Flow Chart

Principal Threat Source Material (PTSM)*



* — Discernable zone of source material or impacted media.

** — Back calculated from MCLs.

Figure 1