

PROTOCOL

Evaluation of Source Materials at SRS Waste Units

Introduction

This protocol has been developed to provide guidance on the evaluation of source materials at SRS waste units, specifically presenting a methodology for determining whether principal threat source material (PTSM) is present.

The concept of principal threat waste and low level threat waste as developed by the U.S. Environmental Protection Agency (USEPA) 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 (USEPA, 1991). Source characterizations are necessary to determine whether the source(s) can be designated as 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 as appropriate for short- and long-term management to prevent or limit exposure

This protocol reflects the U. S. Department of Energy (USDOE), USEPA, and South Carolina Department of Environmental Control (SCDHEC) expectations with respect to defining and managing PTSM at SRS (WSRC, 2005a). The following discussion is divided into three sections: 1) evaluation of source material at SRS, 2) determination of

PTSM, and 3) expectation for addressing PTSM in remedial alternative development and selection.

Evaluation of Source Material at SRS

The determination of whether the source materials present at a waste unit would be classified as PTSM is based principally on USEPA, 1991. In this guidance, the USEPA defines principal threat wastes as “those source materials considered to be highly toxic or mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur”. 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. No “threshold level” of toxicity/risk has been established to equate to “principal threat”. However, the guidance does state that treatment alternatives for source materials should generally be evaluated where the combined toxicity and mobility pose a potential risk of 10^{-3} or greater.

The USEPA, SCDHEC, and USDOE evaluated the USEPA guidance with respect to toxicity and contaminant migration analyses performed at SRS (WSRC, 2005a). In practice, the SRS risk assessment and contaminant migration evaluations identify COCs associated with source material or impacted media and determine the associated risk or potential impact to groundwater. If threshold risk levels are exceeded or groundwater protection standards are predicted to be contravened in less than 1000 years, these problems are identified and an evaluation of remedial alternatives is conducted in the Feasibility Study (FS). Since the risk assessment does not evaluate human receptor exposure to subsurface soils, further evaluation is needed to account for highly toxic source material or contaminated soils at depth that would result in unacceptable risk should exposure occur. However, since the existing program determines contaminant migration COCs for the entire soil column (vadose zone) in the remedial investigation, and addresses these COCs in the FS with evaluation of at least one treatment or removal

alternative, the mobility aspect of PTSM is already being addressed as part of the RI/FS process. Therefore, a separate quantitative determination of whether PTSM exists based on mobility as part of this protocol is not required.

Determination of PTSM

Initially, a qualitative assessment of the source material(s) can be used to determine if the source material 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 lead batteries.

In order to determine whether contaminated source material/soils/sediment should be preliminarily considered PTSM, a simple quantitative assessment evaluating the toxicity of the source is used as described in the following paragraphs.

A source term concentration is established for all the unit-specific constituents (USC) identified. The samples collected from within the source material area or zone of highly contaminated soils/sediment are considered the source group samples. Sufficient process knowledge and characterization is required to adequately define the source term concentration for PTSM determination. The PTSM evaluation is applicable to the entire soil column. Examples include the first few feet of sediment in the bottom of a seepage or discharge basin, the burn/sludge zone at the base of a burning trench, contaminated concrete in a sump, or sludge/sediment in a pipe. Summary statistics (i.e., the mean value, the 95 percent upper confidence limit on the mean [95% UCL] value, and the maximum value) are compiled for each USC associated with each source group. The PTSM exposure point concentration (EPC) is determined by the lower of the 95% UCL or the maximum value and is used to represent the overall source.

In determining whether the source should be considered PTSM, the evaluation considers the cumulative effects of both the potential risk from carcinogenic constituents and the adverse health effects from noncarcinogens to human receptors. Because the most likely future land use scenario for most SRS operable units being evaluated is industrial, the toxicity assessment of the source material is based on the potential exposure of a future on-unit industrial worker. If appropriate, other exposure scenarios should be considered on a case-by-case basis, as agreed to by the project-specific core team. The most current USEPA Region 9 preliminary remedial goals (PRGs) (USEPA, 2004) for industrial scenario exposure to soil were used to develop the PTSM threshold criteria for chemical carcinogens and noncarcinogens. For radionuclides, SGCP radionuclide PRGs (based on the USEPA Radionuclide PRGs for Superfund Electronic Calculator) are used (WSRC, 2003). If a concrete slab or sump is the source material, the PRGs for concrete media (WSRC, 2005b) that were developed by SGCP will be used to identify PTSM.

The source material is preliminarily considered to be PTSM if the cumulative risk exceeds one of the following toxicity threshold criteria:

- Carcinogens - greater than 1×10^{-3} industrial worker risk
- Noncarcinogens – industrial worker hazard index (HI) greater than 10

For carcinogens, the individual risk is calculated by multiplying the ratio of the EPC over the PRG by 1×10^{-6} . Each of these risks is summed to calculate the cumulative carcinogenic risk of the source. For noncarcinogens, an individual hazard quotient (HQ) is equal to the ratio of the EPC over the PRG. These HQ's are summed to derive the cumulative HI.

An uncertainty analysis will be conducted in the RI to further evaluate the constituents and source(s) that exceed the PTSM toxicity criteria. This analysis is intended to help the project-specific core team make a final determination as to the presence of PTSM at the specific unit. Some examples where it may not be appropriate to identify the source as PTSM include: (1) if the source defined as PTSM is of very limited extent or volume, (2)

if the source term concentration appears skewed based on a single value, (3) if a published toxicity value is undergoing additional evaluation, or (4) if the HI exceeds 10 based on the cumulative effects of noncarcinogens that effect different target organs.

Remedial Alternative Expectations

For those source materials that are considered to be PTSM, the remedial action objectives (RAOs) addressing PTSM should be written in a manner consistent with USEPA Guidance (USEPA, 1988). For example, “prevent potential future exposure of an industrial worker to PTSM levels of uranium-238 in concrete at depth”, rather than “treat or remove PTSM levels of uranium-238 in concrete to the extent practicable”. This will allow a full range of alternatives to be considered by the core team in the remedy selection process. Treatment (such as soil vapor extraction, biodegradation, in-situ oxidation, stabilization, grouting, etc.) and off-site disposal alternatives are preferred in the NCP for addressing principal threats. In addition, containment and institutional controls can be evaluated as part of the nine criteria analysis conducted in the FS, considering the level of toxicity/risk, mobility, the volume of the PTSM, the depth below the surface (likelihood of exposure), the likely land-use scenario in the area, and any land use controls that will be required as part of the overall remedy.

References

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