

variance from the applicable treatment standards under current regulations. For a site-specific petition to be granted, it should demonstrate that treatment of the waste significantly limits mobility of mercury from the treated waste and that the treatment residues are stable in the intended disposal environment.

C. What Prompted The Treatability Studies?

On May 28, 1999, EPA published an advance notice of proposed rulemaking (ANPRM) requesting comment to help gain a better understanding of the environmental impact of our waste treatment standards for mercury-bearing hazardous wastes. In the ANPRM, we requested data to support potential alternatives to current LDR requirements to reclaim elemental mercury from high mercury subcategory wastes (*i.e.*, those wastes that contain greater than or equal to 260 mg/kg total mercury). However, we did not receive enough information to propose changes to any of the mercury treatment standards. Therefore, we initiated two research studies to identify the "currently available" treatment processes and to gather information that could be used to potentially change the current mercury treatment standards to assure more effective treatment.

D. What Are the Current Treatment Practices for Mercury Wastes?

In this section, we describe the current regulatory categorization for mercury wastes as low mercury subcategory wastes, high mercury subcategory wastes, or elemental mercury wastes.

1. What Are the Current Treatment Practices for Low Mercury Subcategory Wastes?

Low mercury wastes are those hazardous wastes containing less than 260 mg/kg of total mercury. Current regulations require that these wastes be treated to achieve a certain numerical level, 0.20 mg/L, measured using the Toxicity Characteristic Leaching Procedure (TCLP) for mercury residues from retorting, and 0.025 mg/L TCLP for all other low mercury wastes. These concentrations are generally met by stabilization/solidification treatment. This subcategory of mercury wastes was not included in any of the treatability studies described in this notice.

2. What Are the Current Treatment Practices for High Mercury Subcategory Wastes?

High mercury wastes are those hazardous wastes that contain greater than 260 mg/kg total mercury. Because

of this high concentration of mercury, they are generally required to undergo roasting or retorting (see "RMERC," at 40 CFR 268.42, Table 1). RMERC is defined, in part, as: "Retorting or roasting in a thermal processing unit capable of volatilizing mercury and subsequently condensing the volatilized mercury for recovery." The residuals from the roasting or retorting process are then subject to a numerical treatment standard as discussed above (if the residues meet the definition of "low mercury subcategory").

There may be cases where it is not desirable or practical to retort high mercury subcategory wastes. One example of this would be mixed radioactive high mercury wastes. See the discussion in Section II.K for information on this category of mercury waste.

3. What Are the Current Treatment Practices for Elemental Mercury?

There are three elemental mercury waste streams that contain most of the waste regulated under the LDR program:

(1) Discarded commercial elemental mercury, off-specification elemental mercury, and container and spill residues (RCRA hazardous waste code U151) that contain greater than or equal to 260 mg/kg total mercury. These waste streams must be treated by roasting or retorting (see "RMERC" at 40 CFR 268.42, Table 1).

Additionally, because the uses for elemental mercury in products is declining, stockpiles of excess commodity (bulk) mercury currently exist; if these stockpiles are deemed to be wastes, then they would become subject to the "RMERC" standard.

(2) Elemental mercury contaminated with radioactive materials. These waste streams are required to be treated by amalgamation (see "AMLGM" at 40 CFR 268.42 Table 1). AMLGM is defined as: "Amalgamation of liquid, elemental mercury contaminated with radioactive materials utilizing inorganic agents such as copper, zinc, nickel, gold, and sulfur that results in a nonliquid, semi-solid amalgam and thereby reducing potential emissions of elemental mercury vapors to the air."

(3) Characteristically hazardous elemental mercury wastes (RCRA hazardous waste code D009) that also are required to be roasted or retorted, if they contain greater than or equal to 260 mg/kg total mercury.

E. What Earlier Studies Have Been Performed on Radioactive Mercury Waste?

The Department of Energy's (DOE) Transuranic and Mixed Waste Focus

Area-Mercury Working Group, in conjunction with EPA, has initiated studies of the treatability and disposal of mercury wastes resulting from nuclear weapons production. These treatability studies have evaluated current commercialized state-of-the-art technologies and several emerging technologies. To date, DOE and EPA have conducted several studies of the treatability of contaminated soils, surrogate wastes, and bulk elemental mercury by commercial vendors. The goal of the studies has been to identify the range of conditions suitable for the disposal of these waste residuals, should direct treatment rather than separation be performed. Sepradyne Corporation's vacuum retort extraction, Nuclear Fuel Services, Inc. (NFS) DeHg® stabilization process, Brookhaven National Laboratory's sulfur polymer solidification/stabilization, and ADA Technologies, Inc. (ADA) and Allied Technology Group (ATG) sulfur-based solidification/stabilization processes have been evaluated.

A 1999 DOE study⁶ examined the release of mercury from mercury amalgams prepared by processes operated by ADA Technologies, Inc. (ADA) and Nuclear Fuel Services, Inc. (NFS) as a function of temperature and pH. Leachate exposure experiments indicate that amalgams prepared with zinc released mercury at high rates into the leachate at acidic (low pH) conditions and at lesser rates at neutral pH. These metal-based amalgams tended to perform better in alkaline (high pH) solutions. Sulfur-based treatment samples showed increased release of mercury after two and three months at pH 12.5.⁷ Other studies of mercuric sulfide solubility have detected increased solubility of mercury sulfide complexes above pH 6 with excess sulfide present.⁸ Mercuric sulfide is the product formed from treating elemental mercury with sulfur or sulfide salts. The reports for these prior studies are available on the internet.⁹

⁶ C.H. Mattus, "Measurements of Mercury Released from Amalgams and Sulfide Compounds", Oak Ridge National Laboratory, ORNL/TM-13728, April 1999.

⁷ Ibid. Table 6, page 17.

⁸ Jenny Ayla Jay, Francois M. M. Morel, and Harold F. Hemond, Mercury Speciation in the Presence of Polysulfides, *Environmental Science and Technology*, 2000, Vol. 34, No. 11, pages 2196-2200.

⁹ See C.H. Mattus, "Measurements of Mercury Released from Solidified/Stabilized Waste Forms", Oak Ridge National Laboratory, ORNL/TM-2001/17, April 2001, available at <http://osti.gov/bridge>; and F. Sanchez, D.S. Kosson, C.H. Mattus, and M.I. Morris, "Use of a New Leaching Test Framework for Evaluating Alternative Treatment Processes For Mercury Contaminated Mixed Waste (Hazardous