TABLE 3.—DIETARY EXPOSURE AND RISK TO ACIFLUORFEN[1] FROM DRINKING WATER—Continued

Population	Acute Endpoint		Chronic Endpoint		Cancer Endpoint[3]	
	Exposure µg/L	DWLOC µg/L	Exposure µg/L	DWLOC µg/L	Exposure µg/L	DWLOC µg/L
Children 1 to 6	NA[2]	NA	0.99	40	-	-

[1] Acifluorfen derived from applications of lactofen.
[2] Acute endpoint applies only to females of childbearing age.
[3] Cancer risk is generally reported for the U.S. population.

HED has a concern if the DWLOC for any scenario is below the estimated environmental concentration from the models. All of the DWLOCs shown in the tables above exceed the estimated EECs.

2. *Non-dietary exposure.* Lactofen is proposed only for agricultural uses and no home owner or turf uses. Thus, no non-dietary risk assessment is needed.

D. Cumulative Effects

Section 408(b)(2)(D)(v) requires that the Agency must consider ''available information'' concerning the cumulative effects of a particular pesticide's residues and ''other substances that have a common mechanism of toxicity.'' Available information in this context include not only toxicity, chemistry, and exposure data, but also scientific policies and methodologies for understanding common mechanisms of toxicity and conducting cumulative risk assessments. For most pesticides, although the Agency has some information in its files that may turn out to be helpful in eventually determining whether a pesticide shares a common mechanism of toxicity with any other substances, EPA does not at this time have the methodologies to resolve the complex scientific issues concerning common mechanism of toxicity in a meaningful way.

There are other pesticidal compounds that are structurally related to lactofen and have similar effects on animals. In consideration of potential cumulative effects of lactofen and other substances that may have a common mechanism of toxicity, there are currently no available data or other reliable information indicating that any toxic effects produced by lactofen would be cumulative with those of other chemical compounds. Thus, only the potential risks of lactofen have been considered in this assessment of aggregate exposure and effects.

Valent will submit information for EPA to consider concerning potential cumulative effects of lactofen consistent with the schedule established by EPA in the **Federal Register** of August 4, 1997 (62 FR 42020) (FRL-5734–6), and other subsequent EPA publications pursuant to FQPA.

E. Safety Determination

1. *U.S. population.* Water is not expected to be a significant source of exposure for lactofen, as it degrades quickly in the environment to numerous degradates, including acifluorfen. EECs for lactofen and acifluorfen are well below the DWLOC for chronic, acute, and cancer risk. Therefore, the only significant source of human exposure to lactofen is in food. Residues of lactofen are generally non-detectable at a LOQ of 0.005 ppm, in all food forms. The exposure is <0.1% of the acute and chronic PAD for all population subgroups. Exposure is generally not of concern if it is less than 100% of the PAD. The estimated cancer risk for the U.S. population is 8×10^{-8}, which is more than an order of magnitude less than the risk that is generally considered negligible 1×10^{-6}.

2. *Infants and children.* As stated above, dietary exposure assessments, including drinking water, utilize less than 0.1% of the acute and chronic PADs for all population subgroups, including infants and children. Reproduction and developmental effects have been found in toxicology studies for lactofen but only at levels that were also maternally toxic. This indicates that developing animals are not more sensitive than adults. FQPA requires an additional safety factor of up to 10 for chemicals which present special risks to infants or children. Lactofen does not meet the criterion for application of an additional safety factor for infants and children. The FQPA Safety Factor Committee met on March 13, 2000 to evaluate the hazard and exposure data for lactofen and recommended that FQPA, safety factor for protection of infants and children should be reduced to 3x for lactofen. This safety factor was reduced to 3x by The FQPA, Safety Factor Committee because available data provide no indication of quantitative or qualitative increased susceptibility from *in utero* and/or postnatal exposure to lactofen in rats. Information on the reproduction and developmental effects caused by the other diphenyl ether herbicides is not available to Valent. Additional time is needed for the Agency to evaluate the need for an additional safety factor related to these other chemicals. However, even if an additional safety factor were deemed necessary, the dietary exposures are still expected to be well below the established reference doses.

F. International tolerances.

There are no Codex maximum residue limits established for lactofen on cotton or peanut commodities, so there is no conflict between this proposed action and international residue limits.

[FR Doc. 03–2020 Filed 1–28–03; 8:45 a m]

BILLING CODE 6560–50–S

ENVIRONMENTAL PROTECTION AGENCY

[FRL–7445–4; RCRA–2002–0029]

Land Disposal Restrictions: Treatment Standards for Mercury-Bearing Hazardous Waste; Notice of Data Availability

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of data availability.

SUMMARY: This notice of data availability (NODA) makes available to the public two studies conducted on the treatment of mercury wastes. The studies were initiated to help evaluate whether EPA could propose treatment and disposal alternatives to the current land disposal restriction (LDR) treatment standard of mercury retorting. The studies were performed to assess conditions that affect the stability of waste residues resulting from the treatment of high mercury (greater than 260 mg/kg total mercury) wastes. This NODA also makes available the results of the peer review of these studies. As a result of our investigation, we have concluded that changes to our national regulations are impractical at this time. Additionally, this notice also provides information on how to use the existing treatability variance procedures to make site-specific choices on alternatives to mercury recovery. The treatability studies and the results of the peer review are presented here only to provide information—we are not

requesting comments on the mercury-related issues in this NODA.

ADDRESSES: You may view the supporting materials for this NODA in the EPA Docket Center (EPA/DC), B102, EPA West, 1301 Constitution Ave. NW., Washington, DC 20460–0002. The docket number is RCRA–202–0029. To review file materials, we recommend that you make an appointment by calling (202) 566–0270. The EPA/DC is open from 9 am to 4 pm, Monday through Friday, excluding Federal holidays. You may copy up to 100 pages from any regulatory document at no charge. Additional copies cost $ 0.15 per page. For information on accessing an electronic copy of the treatability study and peer review documents, see the **SUPPLEMENTARY INFORMATION** section.

FOR FURTHER INFORMATION CONTACT: For general information, call the RCRA Call Center at 1–800–424–9346 or TDD 1–800–553–7672 (hearing impaired). Callers within the Washington Metropolitan Area must dial 703–412–9810 or TDD 703–412–3323 (hearing impaired). The RCRA Call Center is open Monday–Friday, 9 a.m. to 4 p.m., Eastern Standard Time. For more information on specific aspects of this NODA, contact Mary Cunningham at 703–308–8453, *cunningham.mary@epa.gov*, or write her at the Office of Solid Waste, 5302W, U.S. EPA, Ariel Rios Building, 1200 Pennsylvania Avenue, NW., Washington, DC 20460.

SUPPLEMENTARY INFORMATION:

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I. How Can I Get Copies of This Document and Other Related Information?

A. Docket

EPA has established an official public docket for this action under Docket Number: RCRA–2002–0029. The official public docket consists of the documents specifically referenced in this action and other information related to this action. Although a part of the official docket, the public docket does not include Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. The official public docket is the collection of materials that is available for public viewing at the EPA Docket Center (EPA/DC), B102, EPA West, 1301 Constitution Ave. NW., Washington, DC 20460–0002. To review file materials, we recommend that you make an appointment by calling (202) 566–0270. The EPA/DC is open from 9 a.m. to 4 p.m., Monday through Friday, excluding Federal holidays.

B. Electronic Access

You may access this **Federal Register** document electronically through the EPA Internet under the ''**Federal Register**'' listings at *http://www.epa.gov/fedrgstr/*.

An electronic version of the public docket is available through EPA's electronic public docket and comment system, EPA Dockets. You may use EPA Dockets at *http://www.epa.gov/edocket/* to access the index listing of the contents of the official public docket, and to access those documents in the public docket that are available electronically. Although not all docket materials may be available electronically, you may still access any of the publicly available docket materials through the EPA/DC facility identified above. Once in the system, select ''search,'' then key in the appropriate docket identification number.

II. What Are the Treatability Studies and Peer Review Results?

A. Why Is Mercury a Concern?

Mercury is an elemental metal, occurs in certain minerals and is a naturally-occurring contaminant of some other natural resources, such as certain types of coal. Once released into the environment, inorganic forms of mercury may be converted to methylmercury, which is the main form of organic mercury found in the environment. Methylmercury may accumulate in fish tissue to levels that are unhealthful to humans and which harm wildlife. Methylmercury has also been shown to be a developmental toxicant, causing subtle to severe neurological effects at very low levels of exposure, especially to fetuses and young children.[1] The developing fetus is exposed to mercury if the mother eats mercury-contaminated fish during pregnancy. Recent data,[2] [3] indicate that 8% of women of childbearing age in the U.S. currently have blood mercury levels higher than EPA considers to be a ''safe'' level of exposure.[4] Children and adults can be exposed to mercury if they routinely eat large quantities of contaminated fish.

The problem of mercury-contaminated fish is wide-spread in the U.S. As of December 2001, 44 states have issued fish advisories for mercury. Twenty-four states have issued statewide advisories.[5] These advisories inform the public that concentrations of mercury have been found in local fish at levels of public health concern. State advisories recommend either limiting or avoiding consumption of certain fish from specific water bodies or, in some cases, from specific water body types (*e.g.*, all freshwater lakes or rivers).

B. What Is The Purpose of This NODA?

Today's notice presents the results of two recent treatability studies conducted to assess the feasibility of the treatment of high mercury wastes (*i.e.*, wastes containing greater than 260 mg/kg total mercury) and elemental mercury destined for disposal. This notice also presents the results of the independent peer review of these two treatability studies.

The existing land disposal restrictions (LDR) treatment standards require recovery by retorting of high mercury wastes. Based on the results of the treatability studies published in today's NODA, we have decided not to propose revisions to the existing treatment standards. We are concerned that treatment (such as the treatment technologies evaluated in our treatability studies) may not result in a waste that is stable under some landfill conditions that are within the range of normal operations.

Having said this, we believe there may be site-specific situations where treatment and disposal of high mercury wastes or excess elemental mercury may be warranted. In these instances, we could grant a petition for a site-specific

[1] *http://www.epa.gov/waterscience/fish/.*

[2] *http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5008a2.htm.*

[3] *http://www.cdc.gov/nceh/dls/report/results/Mercury.htm.*

[4] *http://www.epa.gov/triinter/tridata/tri00/qa.pdf.*

[5] *http://www.epa.gov/waterscience/fish/.*

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 study [6] 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

Continued

F. What Treatability Studies Are the Subject of Today's NODA?

The studies we just described did not focus on two types of mercury waste that we thought were important to address: (1) High mercury (containing greater than 260 mg/kg total mercury) waste sludges that contain multiple forms of mercury; and (2) bulk elemental mercury.

We collaborated with DOE to evaluate the ability of commercially available treatment processes to reduce the solubility of mercury in these two types of waste and to identify stable disposal conditions as a potential alternative to current regulations which require the reclamation of mercury via roasting or retorting before treatment and disposal of the residuals. Because this potential alternative (of treatment/disposal as opposed to roasting/retorting) would result in much higher concentrations of mercury potentially being land disposed, and because of the toxic nature of mercury (see section II.A of this notice) and the difficulty of treatment, we decided to evaluate treated waste forms using the Toxicity Characteristic Leaching Procedure (TCLP),[10] as well as a constant pH leaching procedure that addresses the range of pH conditions that could be expected in hazardous waste landfill disposal environments. Because the TCLP only evaluates one pH condition that results from the interaction of the waste and the fixed acid content of the TCLP leaching solution, we thought it was important to supplement the TCLP with the constant pH leaching procedure to access the performance of the treatment residuals over the range of normal landfill operating conditions. Using this procedure, we examined waste solubility over a pH range from 2 to 12. Even though more extreme conditions have been observed in landfills,[11] a recent compilation of landfill data finds that approximately 95 percent of all hazardous waste landfills are in the 2 to 12 pH range, and more than 90 percent are less than pH 10.[12] By maintaining the pH constant at each level, the test simulates the potential for metals to be extracted or mobilized from the treated waste form by a large volume of landfill leachate passing through and around the waste at the set pH level. This also allows treatment performance to be compared at the set conditions. An exposure period of 14 days, rather than the 18 hours of the TCLP, was chosen to allow all samples time to reach near-equilibrium before measurement of the release potential of mercury from the treatment residuals. Other factors, such as leachate to solids ratio, oxidation/reduction potential (eH), particle size, exposure period, and the major ions present all affect metal solubility. However, the studies presented here primarily focused on the effects of varying pH conditions because the solubilities of metals and metal complexes are highly pH dependent and the pH conditions of hazardous waste landfills are known to vary widely.

The results of these two studies are provided in two reports: ''Technical Background Document: Mercury Wastes—Evaluation of Treatment of Mercury Surrogate Waste'' and ''Technical Background Document: Mercury Wastes—Evaluation of Treatment of Bulk Elemental Mercury,'' available in the docket for today's notice. In this section, we provide an overview of these studies.

The first study evaluated the effectiveness of four technologies to stabilize a ''difficult-to-treat'' mercury waste, representing the wide range of high mercury wastes that could require treatment. A surrogate waste was designed for the study, which included an organic form of mercury, elemental mercury, and several mercury salts in an inorganic matrix. The surrogate waste was treated by each technology vendor. The treated waste was then evaluated for mercury leachability, using both the TCLP and an automated, constant-pH leaching protocol. Prior to leach testing, waste form particles were reduced in size to 9.5 mm or less. The waste forms were exposed to the leaching medium at a 20:1 liquid to solids ratio, and the pH was monitored and adjusted as necessary by computer-controlled addition of acid or base. Constant pH leaching was conducted at pH 2, 4, 6, 8, 10, and 12 for 14 days at each pH. This leaching procedure and the waste surrogate are described in detail in the Technical Background Documents, available in the docket for today's notice.

The second study evaluated the ability of three technologies to convert elemental mercury into a stable waste form. The study was designed to assist in evaluation of options for disposition of the inventory of mercury in the Defense Logistics Agency (DLA) stockpile. Bulk elemental mercury was treated by each technology vendor, and the treated waste residuals were evaluated for mercury leachability, using the same protocols and conditions as those used in the first study.

In both studies, the total concentration of mercury was measured in samples of the untreated starting material (either surrogate waste or bulk elemental mercury), in the treated waste form, and in leachates (both TCLP and constant pH leaching). In addition, samples of the untreated and treated material were characterized, including measurements of bulk density, moisture content, percent organic matter, cation exchange capacity and particle size distribution.

Each of the technologies evaluated in these studies relies on chemical reactions to minimize volatilization and solubility, rather than on recovery or separation technologies which generate a near mercury-free residual in addition to concentrated or purified mercury. These treatment processes are summarized below.

G. What Were the Treatment Technologies Included in Our Treatability Studies?

Four commercial treatment vendors participated in studies of the treatability of the surrogate waste. Because the actual commercial amalgamation processes are proprietary, we refer to the aforementioned treatment technologies as ''vendors'' to mask their identity. Each of the four vendors' processes utilized reagents to bind the mercury forms present as various sulfides. The following table presents a comparison of these technologies.

and Radioactive)'' *http://www.cee.vanderbilt/cee/research_projects.html.*

[10] See 55 FR 11798, March 29, 1990 for more information on the TCLP. The TCLP was originally developed to assess the plausible, worst case mismanagement scenario for evaluating industrial waste codisposed in a municipal solid waste landfill.

[11] 65 FR 37945, June 19, 2000.

[12] Characterization and Evaluation of Landfill Leachate (Draft), SAIC, September 2000, page 3–33.

TABLE 1.—TECHNOLOGIES USED FOR SURROGATE SLUDGE TREATMENT

Comparison factor	Vendor			
	A	B	C	D
Process Overview	Sulfur amalgamation followed by thermoplastic encapsulation.	Formation of mercuric sulfide followed by micro- and macroencapsulation with proprietary binders and coating agents.	Sulfur amalgamation followed by addition of proprietary precipitation reagent.	Formation of mercuric sulfide followed by solidification with a proprietary cement-containing stabilization agent.
Reagents	Sulfur polymer, organic modifier, and proprietary additives.	Sulfide and proprietary binders and coating agents.	Sulfur and proprietary precipitation reagent.	Sulfide and proprietary cement-containing stabilization agent.
Waste Loading** (on dry basis).	30 wt%	72 wt%	44.9–47 wt%	25.4 wt%.
Final Form	Uniform solid mass	Uniform solid mass	Granular	Uniform solid mass.

** Waste loading is the percentage of waste in the treated residue.

Three of the vendors also participated in the treatment of elemental mercury. Vendor D did not participate in this study. Vendors A and B used the same general process for elemental mercury. However, Vendor C used a process that differed from what was used in the surrogate sludge treatment. The following table presents a comparison of the technologies used in the treatment of elemental mercury.

TABLE 2.—TECHNOLOGIES USED FOR ELEMENTAL MERCURY TREATMENT

Comparison factor	Vendor		
	A	B	C
Process Overview	Sulfur amalgamation followed by thermoplastic encapsulation.	Formation of mercuric sulfide followed by micro- and macroencapsulation with proprietary binders and coating agents.	Amalgamation followed by addition of proprietary precipitation reagent.
Reagents	Sulfur polymer, organic modifier, and proprietary additives.	Sulfide and proprietary binders and coating agents.	Amalgamation agent and proprietary stabilization reagent.
Waste Loading** (on dry basis)	33 wt%	44 wt%	20.1 wt%.
Final Form	Uniform solid mass	Uniform solid mass	Uniform solid mass.

** Waste loading is the percentage of waste in the treated residue.

H. What Were the Study Results?

1. What Were the Study Results for the Surrogate Mercury Waste?

Presented in Table 3 and discussed below are the constant pH leaching results for the surrogate mercury waste. Additional testing results (raw data, tables, and graphs) are presented in the report ''Technical Background Document: Mercury Wastes—Evaluation of Treatment of Surrogate Mercury Wastes,'' available in the docket for today's notice.

TABLE 3.—SURROGATE MERCURY WASTE TREATMENT STUDY—CONSTANT LEACHING RESULTS (MG/L MERCURY)

pH	Vendor A **		Vendor B	Vendor C		Vendor D	
	Pellets	Crushed		Batch 1	Batch 2	Batch 1	Batch 2
2*	0.00251/ 0.00856	0.00682/ 0.00294	1.92/ 0.617	0.356/ 13.9	4.39/ 1.11	0.127/ 0.0775	0.257/ 0.130
4	0.00483	0.00555	0.137	0.0816	0.0340	2.63	4.35
6	0.00425	0.0140	0.102	0.0441	0.118	0.240	0.289
8*	0.0127/ 0.00424	0.00180/ 0.00139	0.0873/ 0.0753	0.0391/ 0.0206	0.0106/ 0.00797	0.0603/ 0.0594	0.0724/ 0.0658
10	0.00734	0.00378	0.0577	0.0108	0.00337	2.17	0.0204
12*	0.111/ 0.157	0.781/ 0.136	0.00885/ 0.00609	0.0353/ 0.0336	0.00239/ 0.00264	0.0156/ 0.0109	0.0250/ 0.0193

*Duplicate analyses were performed at pH levels 2, 8 and 12.
**Vendor A provided cast <9mm pellets and a larger material that was crushed to yield a <9 mm form for analysis.

Each vendor's treatment of surrogate waste achieved a significant reduction in mercury release in comparison to the untreated waste form. However, there are significant differences in the effectiveness of the various technologies. Vendor A's stabilized waste leached less than 0.025 mg/L [13]

[13] The current treatment standard for low-level mercury wastes that have not undergone roasting or

Continued

the range of pH 2 to 10. However, when exposed to very alkaline conditions of pH 12, the waste leached 0.111 to 0.157 mg/L in the pellet form and 0.136 to 0.781 mg/L in the crushed form. Vendor B's and Vendor C's stabilized wastes leached increasingly higher levels of mercury at the acidic conditions of pH 4 and lower. Vendor B's stabilized waste achieved 0.025 mg/L only at pH greater than 10. Vendor C's stabilized waste achieved 0.025 mg/L only at pH greater than 6 in one of the two batches. Vendor D's stabilized waste achieved 0.025 mg/L only at pH greater than 10.

2. What Were the Study Results for Elemental Mercury?

Presented in Table 4 and discussed below are the constant pH leaching results for the bulk elemental mercury study. Additional testing results (raw data, tables and graphs) are presented in the report ''Technical Background Document: Mercury Wastes—Evaluation of Treatment of Bulk Elemental Mercury,'' available in the docket for today's notice.

TABLE 4.—BULK ELEMENTAL MERCURY TREATMENT STUDY—CONSTANT LEACHING RESULTS (mg/L MERCURY)

pH	Vendor A		Vendor B	Vendor C
	Pellets	Crushed		
2*	0.00542/ 0.0137	0.00658/ 0.0132	0.00105/ 0.00156	29.7/ 27.9
4	0.984	0.0621	0.00186	0.315
6	0.0835	16.7	0.00484	0.0323
8*	44.9/ 24.3	30.8/ 53.5	0.011/ 0.00832	0.0494/ 0.368
9	13.7	NA	NA	NA
10	0.0742	0.0839	0.0118	0.139
11	0.00951/ 0.0177	NA	NA	NA
12*	127/ 155	74.6/ 23.5	0.143/ 0.0672	0.0251/ 0.0249

*Duplicate analyses were performed at pH levels 2, 8 and 12.
NA—Not Analyzed.

Significant differences were observed between vendors in the treatment of elemental mercury. Vendor A's stabilized elemental mercury exhibited highly variable leaching as a function of pH. The variability observed prompted additional testing at pH 9 and pH 11 to verify and better characterize the significant swings in leachate mercury concentration. Leaching increased from less than 0.01 mg/L at pH 2 to over 24 mg/L at pH 8, reached a minimum of 0.009 mg/L at pH 11, then increased significantly as it approached pH 12 (to greater than 127 mg/L). Vendor B's stabilized elemental mercury shows a gradual increase in mercury leaching (from levels of 0.001mg/L to 0.15 mg/L) with the increasing pH of the leachate fluid. Vendor C's stabilized elemental mercury showed a pattern of decreased leaching with increasing pH, approaching the level of 0.025 mg/L only at a pH of 12. These results clearly show that there are significant differences in the effectiveness of the various treatment technologies. More importantly, the results show that leaching of mercury from the stabilized elemental mercury is pH dependent.

One treatment vendor in Europe, Bjästa Återvinning, has developed a mercury treatment process that results in the formation of mercuric selenide. This vendor was one of the treatment vendors that submitted proposals to the Department of Defense's Defense Logistic Agency (DLA), expressing interest in treating their stockpile of elemental mercury. Mercuric selenide is indicated by solubility calculations to be one of the more insoluble mercury salts. Even though our study was underway, when we learned of Bjästa Återvinning's proposal to treat the DLA stockpile, we were very interested in including their treated waste form in our study. Due to logistical difficulties, we were unable to obtain a treated waste form from this vendor. We were, however, able to obtain laboratory-grade mercuric selenide and conduct limited leachate studies at pH 7 and 10 which bracket the conditions found at many landfills.[14] We also assessed the effects of the addition of 500 ppm of chloride at pH 7 and 10. Unlike the other treated waste forms formed from treatment using a variety of reagents, the final waste form in this case was a known compound: Mercury selenide. Thus, there was readily available information on mercuric selenide solubility and the potential significant effects of chloride on that solubility. Geochemical solubility calculations for the mercuric selenide compound indicated that chloride ions would promote the solubility of mercury. Chloride ions tend to form strong soluble complexes with mercury, greatly increasing mercury's mobility. While mean groundwater chloride concentrations are approximately 160 mg/L, landfill leachates range from 59 to 6,560 mg/L in industrial landfills and 96 to 31,100 mg/L in hazardous waste landfills.[15] In our study, more than a three-fold increase in solubility was observed at both pH conditions with the addition of 500 ppm of chloride. At pH 7, the leachate concentration of mercury increased with the addition of chloride from 0.006 mg/L to 0.021 mg/L; at a pH of 10, the concentration of mercury increased from 0.028 mg/L to 0.11 mg/L. This indicates that major ions present in a given disposal environment may significantly impact the release of mercury from the treated waste form.

I. What Were the Peer Review Results?

The complete results of the Peer Review are provided in the docket to today's notice (Docket Number: RCRA–2002–0029), along with EPA's responses to the Peer Review comments.

retorting is 0.025 mg/L mercury, as measured by the TCLP. Treatment results are presented relative to this numerical benchmark for comparison purposes.

[14] Characterization and Evaluation of Landfill Leachate (Draft), SAIC, September 2000.

[15] Ibid.

1. What Questions Were Asked of the Peer Reviewers?

In order to provide a more complete analysis, and in accordance with EPA policy, we presented the two new studies for formal, independent peer review. The three peer reviewers selected for this process are national experts with significant technical expertise in hazardous waste leaching, have no prior association with these studies, and have no perceived or actual conflict with any impact of the study results. The members of the peer review panel were tasked with evaluating the adequacy of the experimental design, conduct, and conclusions of the two studies. The peer review panel also provided information on how the studies can be used to provide a framework to determine whether additional protective measures are required to prevent loss of mercury to the environment from the treatment and co-disposal of mercury-bearing wastes in landfills.

Additionally, the members of the peer review panel were asked if additional studies were warranted for other factors that impact solubility (*e.g.*, liquid/solid ratio, redox conditions, leachate composition) or affect ability to leach (such as use of macroencapsulation).

2. What Did the Peer Reviewers Say About the Study of the Treatment of Mercury Surrogate Wastes?

Two of the peer reviewers stated that the experimental design was appropriate for the study. One reviewer, however, said the design did not follow the Data Quality Objectives (DQOs) process, and argued that there is little relationship between the objectives and the design. We disagree with this reviewer, however. EPA has developed the DQOs process as the Agency's recommended planning process when environmental data are used to select between two opposing conditions, such as achieving or not achieving a numerical standard.[16] The DQOs process is used to develop qualitative and quantitative statements of the overall level of uncertainty that a decision-maker is willing to accept in results or decisions derived from environmental data, *i.e.*, Data Quality Objectives. The DQOs process entails a seven step systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision error for the study, and how many samples to collect, balancing risk and cost in an acceptable manner. When this process is not directly applicable (*i.e.*, the experimental objective is estimation, research, or any other objective that does not select between two distinct conditions), the Agency recommends the use of a systematic planning method for defining performance criteria.[17] For this research project, a systematic planning method was used. The project planning process used and the planning documents development were guided and overseen by EPA/ORD staff, and the Quality Assurance Project Plan (QAPP) was reviewed and approved by an EPA/ORD quality assurance expert. EPA believes that the project objectives and criteria were logical, given the intended end-use of the data, well-defined, and achievable.

The three reviewers all stated that the study was conducted properly. The three reviewers also stated that the studies met the objectives of: (1) Evaluating the ability of alternative treatment technologies to achieve a goal of 0.025 mg/L or less for the stabilization of mercury over a range of pH levels from 2 to 12; and, (2) to compare constant pH leaching protocol results to standard TCLP results. Two of the reviewers evaluated the ability of each treatment technology to meet the treatment goal, and concluded that the ability of each technology to meet the treatment goal in the constant pH leaching was pH-dependent.

The reviewers suggested additional studies to fill in specific data gaps. One reviewer noted that additional extractions up to at least pH 12.5 are needed to supplement the report. While we agree evaluation of a broader range could be helpful, we do not believe that additional studies are cost effective, because only a small fraction of hazardous waste landfills have been observed to have leachates above pH 12. In cases where disposal is proposed at or above pH 12.5, additional data for such conditions may be necessary to establish that treatment is effective for the expected disposal conditions. (See section II.F of today's notice for a discussion of pH levels in hazardous waste landfills.)

Another reviewer suggested that two or more actual wastes (rather than surrogates) containing over 260 mg/kg of mercury be subjected to stabilization and leaching by the TCLP as well as by the constant pH protocols. EPA agrees that using actual wastes, rather than surrogates, for treatability tests can be desirable. However, in many cases during the history of establishing treatment standards in the BDAT program, EPA has used surrogates in lieu of actual wastes, whenever representative ''hard-to treat'' wastes were not readily obtainable. Specifically, in the case of characteristic wastes, which can be extremely variable, using a surrogate allows us to evaluate a ''hard-to-treat'' waste. Using a ''hard-to-treat'' waste is useful if the ultimate treatment results will be used for other forms of that waste, which in the case of a characteristic waste like D009, is likely the case. In the studies discussed in this notice, where we were trying to determine how these forms of mercury would respond to treatment and determine how the treated waste forms would react to various pH environments, we are comfortable that using surrogate wastes did not diminish the value of the studies.

3. What Did the Peer Reviewers Say About the Elemental Mercury Study?

One of the peer reviewers agreed that the experimental design was appropriate for the study. Another reviewer said that a statement of acceptable errors should have been included (*e.g.*, a treatment technology must be effective on 90% of wastes with a 90% confidence). Without such a statement, he said, it is difficult to decide when a technology provides adequate treatment. EPA believes that a statement of acceptable errors as constructed by the reviewer was not appropriate. The objective of the study was to determine how these forms of mercury would respond to treatment and to determine how the treated waste forms would behave in various pH environments.

Another reviewer also said the experimental design was generally appropriate; however, it failed to confirm that concentrations of elemental mercury in the treated wastes were at the values reported by the vendors. He added that the recoveries (*i.e.*, measure of total mercury present) for treated elemental mercury wastes submitted by Vendors A and C are so low that they cast doubt on the results of the leach tests. We disagree. The analysis of mercury content of the treatment residuals and that of the leachates are two distinct analyses. The low recoveries for the treated elemental mercury wastes were a result of the difficulty in digesting the solid waste form to dissolve the mercury and make it available for analysis; as a result, waste loadings reported by the vendors could not be verified. Regarding the leach tests, all spike recovery measurements of the leachates achieved

[16] See EPA/600/R–96/055; Guidance for the Data Quality Objectives Process. *http://www.epa.gov/quality/qs-docs/g4-final.pdf*

[17] Ibid.

quantitative recoveries between 84% and 109%. Thus, there is no evidence of a problem with the analysis of mercury in the leachates. We believe this is because the mercury was in solution, and therefore, available for analysis.

All reviewers said that the study was conducted properly. Reviewers were then asked whether the stated objectives were adequately met. All reviewers agreed that the studies met the objectives of: (1) Evaluating the ability of alternative treatment technologies to achieve a goal of 0.025 mg/L or less for the stabilization of mercury over a range of pH levels from 2 to 12; and, (2) to compare constant pH leaching protocol results to standard TCLP results.

The reviewers all agreed that the results of the bulk elemental mercury study supported the conclusion that the presence of chloride ions in a given disposal environment may significantly impact the release from a treated waste form (mercury selenide).

4. What Additional Studies Are Recommended?

When asked if further studies were recommended for other factors that impact solubility, one reviewer recommended additional extractions up to at least pH 12.5. Again, as described above, we do not agree that additional studies are warranted for this pH range, as few landfills have been shown to maintain pH conditions in excess of pH 12. This reviewer also recommended that mercuric selenide waste should be evaluated over the range of pH 2 to 12.5, with varied chloride content in the leachate. We agree that if additional studies were planned, it would be useful to further investigate mercuric selenide or elemental mercury treated to a mercuric selenide composition across a wider range of pH values than the 2 pH conditions in our study. We also believe that varying chloride content and other potentially significant variables across the pH range for all waste forms would be a useful study, and would provide additional information on the potential effects of chloride content in landfill leachate.

5. Must Site-Specific Disposal Conditions Be Considered Along With Appropriate Treatment Technology as Decisions Are Made About Disposal of Mercury Wastes?

Peer reviewer opinions were mixed as to whether the studies supported the assertion that site-specific disposal conditions must be considered along with appropriate treatment technology as decisions are made about disposal of mercury wastes. One reviewer stated that the studies provide useful data on pH and chlorides, but do not provide adequate support for an absolute requirement. The reviewer also stated that, ''For any disposal of hazardous wastes, treated or untreated, it is scientifically preferable to use site-specific information.'' This reviewer maintained, however, that requiring the factoring of site-specific conditions into decision making is not always feasible. Another reviewer's comments countered that these research results do support the assertion, because they demonstrate that leaching fluids, which vary greatly in pH under different disposal conditions, can have an important impact on the amount of mercury leached from the treated wastes. The third reviewer suggested that if several actual wastes have been tested and are shown to be stable at all pH values, then selection of stabilization technology would not require any site-specific considerations. We do not agree with this reviewer's comment, because we believe that there are other factors (redox conditions, presence of chlorides, *etc.*) besides pH, which would likely impact the solubility of the treated waste form.

The complete results of the peer review are provided in Docket Number: RCRA–2002–0029, along with EPA's responses to the peer review comments.

J. What Conclusions Do We Reach From the Treatability Studies?

For wastes containing a wide range of mercury compounds, treatment can result in a residual of reduced solubility under certain pH conditions. Our treatability studies showed that the leaching of mercury out of the stabilized waste form varied with pH. We saw that some of the vendor's treatment of surrogate waste performed better in certain pH ranges. For example, Vendor A performed best (*i.e.*, achieved levels less than 0.025 mg/L) except in very alkaline conditions (*i.e.*, when the pH was greater than 10), whereas Vendor B's treatment performed best only under very alkaline conditions. Because the pH in a hazardous waste landfill can vary anywhere from near pH 2 to over pH 12, it appears that none of the treatment processes tested in the studies presented here are effective for the entire range of pH levels that could exist.

We find that the evaluated processes are effective to a degree for the treatment of elemental mercury wastes. Several have been demonstrated to achieve 0.025 mg/L or better under certain pH conditions. However, vapor pressure measurements [18] and observation of small droplets of mercury in some samples of the treated wastes lead us to believe that some treatment processes did not result in complete treatment of all the elemental mercury in every test sample. We also believe that the testing conditions cannot be considered to be worst-case, because the additional presence of sulfide and chloride ions in leachates can promote formation of soluble mercury complexes.

The physical properties of elemental mercury present significant challenges to its long-term management. Mercury cannot be destroyed. Elemental mercury is easily vaporized due to its vapor pressure at ambient temperatures. Also, elemental mercury is not significantly soluble [19] and therefore not readily detected by short term leachate tests, such as the TCLP. Disposal of large amounts of elemental mercury require control of both volatilization losses and any subsequent solubilization in leachates. Thus, for protective long-term management in a disposal environment, elemental mercury first has to be treated to convert it to a form with reduced volatility and solubility, and then measures must be put into place to prevent these treatments from being degraded once the properties of the treatment residual have been determined.

The physical properties of mercury also present treatment challenges. At ambient conditions, mercury is an extremely dense liquid with high surface tension. It does not appreciably dissolve into, or adhere to, wastes or environmental media, and because of its density and surface tension, it is extremely difficult to distribute homogeneously through the treatment reagents. Consequently, large volumes of treatment reagents are needed to contact and react with the elemental mercury, resulting in low waste loadings and large volume increases.

The current treatment standard for high mercury and elemental mercury wastes is recovery of mercury followed by land disposal of any treatment residuals that pass a leaching standard.[20] The results of the treatability studies outlined in this notice lead us to conclude that, at this time, we cannot

[18] 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*.

[19] The solubility of elemental mercury is 0.056 mg/L at 25°C (MERCK Index).

[20] Residuals that do not pass the leaching standard would require additional treatment to meet the standard for the applicable subcategory of mercury waste.

establish a new national treatment standard allowing for disposal of high mercury and elemental mercury wastes. We continue to believe that the current recovery standard is the most appropriate standard for most high mercury waste. No technology demonstrated adequate stability across the plausible range of pH conditions found in landfills. We recognize that other factors, including leachate salinity, can have a significant effect on the solubility of treated mercury wastes. These other factors may be the reason that we have not been able to find a single technology that is effective in all or many situations.

K. Why Are Treatability Variances an Option for High Mercury Wastes?

While these circumstances do not allow us to modify or provide an alternative national treatment standard for high-mercury hazardous wastes to allow for disposal, we are deferring to our variance process for stakeholders who believe it would be appropriate to use an alternative treatment technology for their wastes and expected disposal conditions. Under 40 CFR 268.44(h), we allow facilities to apply for a site-specific variance for wastes generated under conditions specific to only one site. In such cases, the generator or treatment facility may apply to the Administrator, or EPA's delegated representative, for a site-specific variance from a treatment standard.

In cases where roasting and retorting for a certain waste is inappropriate, a generator can consider petitioning for a site-specific variance from that treatment standard. At a minimum, the generator would want to look for the treatment technology that would be most effective in the expected pH range for the chosen disposal site. In general, for a site-specific petition to be granted, it should demonstrate that treatment has occurred and that the treatment residues are stable in the intended disposal environment.

For example, a variance may be appropriate for a high mercury subcategory waste that also is radioactive (*i.e.,* a mixed waste). The current regulations require high mercury-organic subcategory mixed wastes be treated by retorting (RMERC) or incineration (IMERC) and high mercury-inorganic subcategory mixed wastes be treated by RMERC. At the time of promulgation, the assumed approach for compliance with these regulations was separation of the mercury from the wastes and recycling of the pure elemental mercury back into commerce. However, this assumed compliance scenario is invalid for mixed wastes containing mercury because there is no use for recovered mercury that is radioactively contaminated.

To manage this type of waste, it would appear reasonable to use, on a site-specific basis, the ''inappropriate'' variance approach (§ 268.44(h)(2)(i)). A petitioner using this approach would necessarily have to describe the specifics and likely effectiveness of the stabilization treatment that will be used. As demonstrated by the studies described in today's notice, the stability of treated waste forms can be highly dependent on pH conditions. In determining whether the proposed technology is protective, EPA would expect the petitioner to demonstrate the technology's effectiveness under the planned disposal conditions.

LDR variance petitions should be submitted in accordance with the procedures in 40 CFR 260.20. Petitions should include, among other things, a description of the process that generates the waste, the rationale for the variance request, and data on the proposed waste treatment process.[21] Site-specific circumstances often dictate the types and amount of information that we will need to evaluate a petition, so stakeholders who are considering petitioning for a treatment variance should engage EPA early in the process to ensure all of the necessary information is, or will be, available.

L. What Other Implications Arise From the Treatability Studies?

Because these treated waste forms may be chemically altered by environmental conditions, macroencapsulation prior to land disposal could be used to provide a barrier against leachate intrusion and attack on the treated mercury waste. Macroencapsulation would also provide a barrier to reduce emissions of elemental mercury vapors. In order to meet the performance requirements of 40 CFR 268.45, Table 1, the macroencapsulation treatment must completely encapsulate the waste and be resistant to degradation by the waste, its contaminants, and materials into which it may come into contact after placement. We promulgated such a requirement for wastewater treatment sludge from the production of vinyl chloride monomer using mercuric chloride catalyst in an acetylene-based process; hazardous waste K175 (65 FR 67068, November 8, 2000). For K175 wastes, we estimated that macroencapsulation and placement in a hazardous waste landfill utilizing high density polypropylene vaults adds an additional $150 to $200 per ton of waste disposed to the treatment costs.[22] For a review of the current state of encapsulation technologies and materials being used to immobilize elemental mercury, mercury-contaminated wastes, soils, or sludges, see the technical report ''Advances in Encapsulation Technologies for the Management of Mercury-Contaminated Hazardous Wastes,'' Battelle, August 30, 2002, available in the docket for this notice.

Having concluded that treatment residues of elemental mercury are potentially subject to attack by leachates and that the technologies may not have fully reacted with the mercury, we are evaluating whether to propose modifying the treatment standards for the radioactive elemental mercury waste subcategories of U151 and D009. The current treatment standard for these wastes is amalgamation (AMLGM). We could propose, for example, to replace this standard with the more restrictive requirement of amalgamation followed by macroencapsulation. We could also require post-treatment testing to ensure effective treatment. If we decide to amend the treatment standards, we would publish a proposed rule for public comment.

Dated: January 22, 2003.

Robert Springer,

Director, Office of Solid Waste.

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[21] Note that when submitting data, petitioners should also include evidence that appropriate quality assurance/quality control procedures were followed in generating the data. For guidance, see Final Best Demonstrated Available Technology (BDAT) Background Document for Quality Assurance/Quality Control Procedures and Methodology; USEPA, October 23, 1991.

[22] Economics Background Document—USEPA Final Rule Listing Wastewater Sludges Generated By Chlorinated Aliphatic Chemical Manufacturing Facilities, as RCRA Hazardous Waste Codes K174 and K175: Industry Profile and Estimation of Regulator Costs; page 74. *http://www.epa.gov/epaoswer/hazwaste/id/chlorali/ca_ebd.pdf*

ENVIRONMENTAL PROTECTION AGENCY

[FRL–7444–6]

Connecticut Marine Sanitation Device Standard; Receipt of Petition

Notice is hereby given that a petition has been received from the State of Connecticut requesting a determination of the Regional Administrator, U.S. Environmental Protection Agency, pursuant to section 312(f)(3) of Pub. L. 92–500 as amended by Pub. L. 95–217