

US EPA ARCHIVE DOCUMENT

DCN FLEP-00006

COMMENTS Owens Brockway Glass Container Inc.

SUBJECT TOX

COMMENT The risk that mercury contained in waste lamps poses to the environment and the public health have been greatly overestimated in the proposed rule. The fact that the EPA has assumed that all waste, mercury-containing lamps are hazardous by definition overestimates the potential risk that landfill disposal of the lamps will create. Owens Brockway has conducted TCLP analysis on waste, energy efficient fluorescent lamps prior to disposal, and in several cases the waste was not RCRA hazardous. Furthermore, GE has published literature that indicates that their energy efficient fluorescent lamps are not hazardous when new or spent. The mercury used in lamps is nearly all in elemental form, is very insoluble and does not appreciably leach. The lighting industry has and is continuing to lower the content of mercury contained in its lamps. Therefore, the percent of these lamps that are actually hazardous waste are less than the EPA has estimated and this percentage will continue to decrease over time. This reduction in the quantity of mercury containing lamps classifiable as a hazardous waste, further supports adoption of Option 1 as the better means to achieve the most significant reduction of mercury emissions as a result of the increased use of energy efficient lighting and the subsequent decrease in electrical generation demands.

#### RESPONSE

The Agency notes that EPA has not assumed that all waste mercury-containing lamps are hazardous by definition, as the commenter indicates. Waste lamps are hazardous only if they fail the TCLP for a hazardous constituent or exhibit the characteristics of ignitability, corrosivity, or reactivity. Thus, if, as the commenter states, mercury levels in lamps are steadily falling to the point that disposed lamps do not exhibit the TC for mercury or any other hazardous waste characteristic, the lamps will not be subject to this rule or other subtitle C regulation.

Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule is less stringent than full Subtitle C management standards).

The Agency takes issue with the comment that mercury in lamps is immobile, the implicit suggestion being that the TCLP is an improper model for evaluating the toxicity of these wastes.

As stated in more detail in other comment responses, actual data from CERCLA NPL sites and other sources corroborates earlier data cited in the proposal that mercury is both capable of migrating from waste matrices in municipal landfills, and can and has done so in concentrations clearly harmful to human health and the environment (in some cases reaching drinking water wells in concentrations exceeding the federal drinking water standard or State counterpart; in other cases comprising an appreciable fraction of that standard). Moreover, as further stated in other responses, mercury in lamps is typically in the divalent form, which forms mercury salts which are water soluble and so are readily capable of migration from a landfill. Therefore, EPA does not agree with the commenter that mercury in lamps will be released in insoluble, elemental form. Data thus show that mercury can be found in municipal landfill leachate, and EPA remains concerned that landfill releases may pose threats over the long term, particularly given mercury's potential to bioaccumulate. The Agency has concluded that some RCRA management controls are essential for these wastes.

The Agency published a Notice of Data Availability on July 11, 1997 (62 FR 37183). This notice presented data collected by the Agency and an assessment of potential mercury emissions to the air from the management of hazardous waste-containing lamps under several regulatory approaches. As noted above, this study also identified data indicating that mercury in spent lamps is primarily in the ionic rather than elemental form (see pp. 2-4 of EPA's Mercury Emissions Study). Many mercury salts that may be found in the lamps or subsequently formed in the landfill are more soluble, and therefore more likely to be mobile in groundwater than is elemental mercury. As noted, empirical, quantified data from RODs and other publicly available sources corroborate EPA's qualitative predictions.

The Agency believes that certain controls under RCRA are needed to minimize the release of mercury from lamps into the environment. Although most mercury emissions are associated with combustion, all releases contribute to the mercury reservoirs in land, water and air. In addition, mercury has been shown to be transported in the atmosphere many miles from the source of its release. The deposition of atmospheric mercury into surface waters, its presence in runoff from soil, or the recycling of mercury from sediment into the water column can result in the accumulation of the metal in many animal species, particularly aquatic organisms. In December 1997, the EPA published a Mercury Study Report to Congress that examines many of the health effects resulting from mercury exposure. Examples of mercury-related risks include neurotoxicological problems and developmental effects in fetus and adults (e.g., Mad Hatter's disease), and accumulation of the metal in many animal species, particularly aquatic organisms. For example, fish with high levels of mercury in their tissues have exhibited increased mortality, reduced reproductive success, impaired growth, and behavioral abnormalities.

The Agency agrees with the commenter's assertion that the lighting industry has and is continuing to lower the content of mercury contained in lamps. Today's final rule creates an incentive for lamp manufacturers to produce and consumers to use lamps that, when spent, pass the TCLP and are not subject to the hazardous waste lamp rule.

DCN FLEP-00059

COMMENTER Connecticut Dept. of Env. Protection

SUBJECT TOX

COMMENT c) DEP has seen considerable data which shows, that many types of spent mercury containing lamps also frequently fail TCLP testing for lead. As with the above, keeping this source of lead out of landfills is appropriate to minimizing risks of environmental contamination.

#### RESPONSE

The Agency agrees that some lamps fail the TCLP for lead. Spent lamps that fail the TCLP for lead or any other hazardous constituent or that exhibit any of the other hazardous waste characteristics are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to LDR standards before disposal, unless they are recycled.

DCN SCSP-00077

COMMENTER U.S. Department of Energy

SUBJECT TOX

COMMENT Additionally, the National Electrical Manufacturers Association, in conjunction with EPA's Office of Solid Waste, tested and found fluorescent light tubes to consistently fail the toxic characteristic leaching procedure (TCLP) for mercury. [1] [Footnote 1: "NEMA Inter-Laboratory (sic) TCLP Testing, Final Report of Results", issued January 7, 1992.] (1)The waste is listed in Subpart D of 40 CFR Part 261, or (if not listed) the proportion of the waste stream that exhibit one or more of the characteristics identified in Subpart C of 40 CFR Part 261; Fluorescent lamps are not listed in Subpart D of 40 CFR Part 261. Fluorescent lamps generally fail the toxicity characteristic test for mercury by the toxic characteristic leaching procedure (TCLP) method. This determination is based on in-house TCLP tests of representative samples of individual lamps, TCLP test data and information received from various lighting manufacturers and the National Electrical Manufacturers Association (NEMA), and TCLP data contained in a study performed by member companies of the Lamp Section of NEMA in conjunction with EPA. [2] [Footnote 2: "NEMA Inter-Laboratory (sic) TCLP Testing, Final Report of Results," issued January 7, 1992.]

#### RESPONSE

The Agency thanks the commenter for the comments and the additional data submitted. EPA studies have determined that the majority of spent lamps currently fail the TCLP for mercury and that some spent lamps also fail TCLP for lead. Spent lamps that fail the TCLP for any hazardous waste constituent or exhibit any other hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to meet LDR standards, before disposal, unless they are recycled.

DCN SCSP-00077

COMMENTS U.S. Department of Energy

SUBJECT TOX

COMMENT High-intensity discharge lamps are not listed in Subpart D of 40 CFR 261. Generally, mercury vapor, high-pressure sodium, metal halide street, and other similar lamps utilized in high-bay areas or warehouses are considered high intensity discharge lamps. Manufacturer's data indicates that mercury and metal halide high-intensity discharge lamps contain between 13 and 250 milligrams mercury per lamp; however, TCLP data was not available for review. High-intensity discharge lamps contain lead solder used on the base of the lamps and generally fail the toxicity characteristic test for lead by the TCLP method. This determination is based on TCLP data and information received from lighting manufacturers.

#### RESPONSE

The Agency thanks the commenter for the comments and the additional data submitted. The final definition of *lamp* includes all the types of lamps mentioned by the commenter. The final definition (40 CFR 260.10 and 40 CFR 273.9), specifies that a *lamp*, also referred to as a *universal waste lamp* is defined as the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infrared regions of the electromagnetic spectrum. Examples of common universal waste electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps.

EPA studies have indeed determined that the majority of spent lamps fail the TCLP for mercury and that some spent lamps also fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous waste constituent or exhibit any hazardous waste characteristic are also subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. The universal waste rule

provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to meet LDR standards before disposal, unless they are recycled.

DCN SCSP-00077

COMMENTS U.S. Department of Energy

SUBJECT TOX

COMMENT EPA has requested that they be supplied with any available data pertaining to whether or how often the wastes are hazardous [58 FR 8110]. Additionally, EPA has requested submittal of any available quality assurance and quality control documentation of the sampling procedures and test methods used. No in-house data is available for the incandescent and high-intensity discharge lamps, and this information should (more appropriately) be supplied by lighting manufacturers. Bulbs manufactured by General Electric Lighting, Philips Lighting Corporation, Sylvania Lighting, and Westinghouse were sampled, and a comparison of mercury leachability was made utilizing the EP toxicity test and TCLP. The conclusion of this study was that no significant difference in test results were shown due to effects from the filtration media (membrane filter for EP toxicity and glass fiber filter for TCLP). Summarizing the mercury data, two of the samples far exceeded the limit in the extract of 0.2-milligrams/liter. These values were the Westinghouse Circular 32 Watt at 0.75-milligrams/liter (TCLP) and the Sylvania Day Light 40 Watt at 0.86-milligrams/liter (TCLP). However, the author noted that the remaining samples were very near the limit, and some of the numbers might have been slightly higher than those reported had a bias correction been applied. The study concluded that all lamps tested should be managed as hazardous waste when discarded. Various factors contribute to the variability in TCLP data for fluorescent lamps, making interpretation of TCLP data difficult. Discussions with lighting manufacturers have indicated that the amount of mercury in fluorescent lamps varies widely (1) from one model lamp to another, (2) between the same model lamp manufactured by different manufacturers, and (3) between the same model lamp manufactured by the same manufacturer in different plants. Other variable factors noted include the length of the lamps (generally the longer the lamp, the more mercury it contains), the operating life of the lamps, the method of sampling the lamps, and variability in performance of TCLP.

## RESPONSE

The Agency appreciates the information on TCLP testing submitted by the commenter. EPA studies have also determined that the majority of spent lamps fail the TCLP for mercury and that some spent lamps also fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous waste constituent or exhibit any hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to LDR standards before disposal, unless they are recycled.

The Agency also agrees that there are many factors relating to lamp design, manufacture, and use that contribute to variations in the TCLP test results for lamps. All of the factors cited by the commenter can contribute to TCLP variability.

DCN SCSP-00077

COMMENTS U.S. Department of Energy

SUBJECT TOX

COMMENT 1. The point of generation for fluorescent lamps is the point at which the spent lamp is removed from the light fixture. A representative sample of a drum of crushed lamps may dilute the waste stream to the extent that a characteristic would not be exhibited and would not be representative of the waste at the point of generation. Therefore, a case-by-case hazardous waste determination of individual lamps is necessary to determine compliance. A representative sample of this waste would necessitate processing the entire lamp. Due to variabilities in (1) mercury content of individual lamps, (2) sampling, and (3) TCLP methods, it cannot be determined whether any individual lamp may fail unless tested. Obviously, testing each lamp generated would be cost prohibitive; therefore, for compliance sake, all lamps must be handled as hazardous waste. The same logic for representative sampling of incandescent lamps and high-intensity discharge lamps would apply as well; however, currently the same variability is not noted in the TCLP data, (i.e., the lamps typically fail (for lead)). However, this scenario may change as the lighting manufacturers experiment with lamps manufactured with different solders. If this is the case, the same variability in TCLP data could be exhibited for incandescent lamps and high-intensity discharge lamps as for fluorescent lamps.

## RESPONSE

The Agency notes that generators of waste are not required to test their waste to determine if it is hazardous waste and may apply their knowledge of the waste to make a hazardous waste determination. EPA studies have also determined that the majority of spent lamps fail the TCLP for mercury and that some spent lamps also fail the TCLP for lead. Test results from a large number of generally representative lamps may be used by generators as a basis for making a hazardous waste determination without testing each lamp. If most lamps tested by a generator fail the TCLP, management of all similar lamps as hazardous waste is the most prudent approach.

Spent lamps that fail the TCLP for any hazardous constituent or exhibit any hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to LDR standards before disposal, unless they are recycled.

DCN SCSP-00080

COMMENTER Technical Comm., S.C. Chamber of Comm.

SUBJECT TOX

COMMENT Further guidance concerning fluorescent light tubes issued by EPA Regions I and V supports that these items are hazardous waste. Testing conducted by the National Electrical Manufacturers Association in association with EPA Office of Solid Waste indicates that fluorescent light tubes consistently fail the Toxic Characteristic Leaching Procedure for mercury. Given this evidence EPA is strongly urged to consider including fluorescent light tubes in Part 273.

## RESPONSE

The Agency notes that fluorescent lamps are included in the final definition of lamp in 40 CFR 273. The final definition (40 CFR 260.10 and 40 CFR 273.9), specifies that a *Lamp*, also referred to as a *universal waste lamp* is defined as the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infra-red regions of the electromagnetic spectrum. Examples of common universal waste electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps.

The Agency also notes that today's final rule adds hazardous waste lamps to the scope of the universal waste rule (40 CFR Part 273). EPA studies have determined that the majority of hazardous waste lamps fail the TCLP for mercury and sometimes for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any of the hazardous waste characteristics are subject to today's rulemaking.



DCN FLEP-00090

COMMENTS The Boeing Company

SUBJECT TOX

COMMENT The company shares the agency's objective of managing hazardous wastes in an environmentally sound manner. We appreciate the agency's long-term developmental work on the MINTEQ model to evaluate the fate and transport of the TC metals for purposes of re-assessing the regulatory levels for toxicity characteristic metals. In light of the progress made by lamp manufacturers in source reduction of mercury, and the agency's latest analysis from its MINTEQ model, it seems appropriate to re-evaluate the management of waste mercury-containing lamps.

#### RESPONSE

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L for mercury and a slightly more protective point on the probability distribution curve (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

EPA's technical conclusions regarding the environmental fate of mercury released from lamps disposed in a municipal landfill do not, however, rest solely on these predictive fate and transport models. Because of significant commenter interest in the leaching and groundwater fate and transport of mercury in landfills, the Agency has reviewed two readily and publicly available data sources on the release of mercury to groundwater from landfills, and also preliminary results of an ongoing Agency study on landfill leachate. The first data source is the 1996 Hazardous Waste Characteristics Scoping Study in which the Agency identified verified releases of chemicals (including mercury) from industrial non-hazardous and construction and demolition landfills. The second data source is a set of Records of Decision (RODs) created by the CERCLA program in studying contaminated sites and developing remedies for the sites. RODs that identified mercury as a site contaminant, and municipal landfills as the source or potential source of contamination were examined. This review of CERCLA RODs expands and updates the Agency's examination of RODs from 1990 and 1991 done for the mercury lamps proposal (59 FR 38291). The preliminary data are from an ongoing study of landfill leachate in which the Agency is collecting

leachate contaminant concentrations (including mercury) at several types of operating and closed landfills.

The Scoping Study identified 112 cases where release of contaminants from industrial non-hazardous waste management could be verified and release data were available. Most sites had verified data because state-supervised remediation had been or was being conducted at the site; data were available from public state files. Of the 112 cases identified, 19 (17%) identified mercury releases, primarily to groundwater. Either state or federal regulatory standards were exceeded in 6 of the 19 cases (32%, or 5% of the total cases; 5 cases exceeded federal or state MCLs; one exceeded a soil clean-up value). Only general data on the waste disposed in these units were available, although several locations with MCL exceedences received paper mill sludges.

The Agency also reviewed additional data in CERCLA RODS dating from 1985 through 1997 to see whether mercury releases have occurred at MSW landfills where remediation was required. Of the 1211 current sites on the NPL, 82 are identified by SIC code as MSW landfills. Approximately 150 NPL sites (total) include *landfill* or *dump* in their name, and which, on examination of their RODs, were found to have accepted MSW during their operating life. Of these, mercury was detected at 39 sites (26% of MSW sites; 51 RODs-- some sites have multiple RODs). Mercury concentrations in groundwater or surface water exceeded the MCL at five sites clearly identified as MSW units, and the MCL was exceeded at two more units that were not identified as MSW landfills by SIC code. Two RODs identified residential drinking water wells as sampling locations, one with mercury far above the MCL, and one with mercury equal to the MCL at the well, at distances up to one and a half miles from the source of contamination. Five more facilities had groundwater or surface water contaminated with mercury at 10% or more of the MCL concentration. Data on waste disposed in these landfills were not available.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time-span. The RODs discussed in the mercury lamps proposal concerned only municipal solid waste disposal sites and date only from 1990 and 1991. In that review, the Agency identified mercury as a constituent of concern at 12 of 66 sites that received municipal solid waste. Of these, five sites had wells contaminated with mercury at concentrations above the MCL. While the Agency did not view the ROD data at proposal as an indication that significant amounts of mercury are being released from MSW landfills, data from the expanded and updated RODs analysis show that this preliminary conclusion was not correct, and that mercury contamination of groundwater from landfills is more widespread than previously believed. However, even the original RODs review discussed in the proposal indicated that mercury does leach from MSW landfills. However, the Agency noted that four of the five sites also received industrial waste, and focused only on data from the remaining site. The data from that site showed on-site mercury concentrations above the MCL and off-site groundwater samples below detection limits for mercury. It is apparent that the hasty inference from one site that mercury contamination will not spread off-site was unwarranted.

Finally, as part of its efforts to review the TCLP test and its application in the RCRA programs, the Agency has collected data on landfill leachate composition for MSW, industrial D, and hazardous waste landfills. Preliminary analysis of the MSW landfill data from the study identified mercury (total) in 10/170 leachate samples, with the median mercury concentration (where mercury was found) at 40% of the MCL (0.0008 mg/l), and the 90<sup>th</sup> percentile value 30 times the MCL concentration, or at 30% of the toxicity characteristic value (0.061 mg/l). The hazardous waste landfill leachate showed higher mercury concentrations, and the industrial, non-hazardous landfills showed lower mercury concentrations in the leachate.

These data clearly show that the TCLP test and the dilution/attenuation factor used for mercury in the toxicity characteristic rule are at best only slightly conservative for mercury, and do not grossly overestimate mercury leaching and groundwater fate and transport. They show very clearly that mercury can be leached from waste and released to the groundwater at levels that are significant to the environment, from several landfill types, including MSW landfills. In MSW landfill leachate, mercury at 30% of the toxicity characteristic value indicates that the TCLP test may be somewhat, but not excessively conservative. Mercury in groundwater at levels exceeding the MCL indicates clearly that mercury can not only leach from waste but can also be transported at environmentally significant concentrations in groundwater. Given these data, the Agency's preliminary conclusion that mercury is not being readily leached from MSW landfills appears to be unfounded.

These data could be used to update the analysis of mercury releases from landfills in the RTI report, and would undoubtedly show an increased rate of release compared with EPA's 1992 analysis. However, and more significantly, these data show not only mercury releases at higher concentrations in the leachate, they also show environmentally significant levels of mercury in groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate

that a significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.

Today's final rulemaking has not changed the regulatory limit for identifying wastes as exhibiting the Toxicity Characteristic for mercury (i.e., 0.2 mg/L using the TCLP). EPA studies have determined that the majority of spent lamps exceed this limit for mercury. In addition, studies have shown that some spent lamps fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste pursuant to 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). The Agency may at some future time reevaluate how it regulates mercury-bearing wastes, including lamps, but is not doing a comprehensive reevaluation of mercury regulation today.

DCN FLEP-00130

COMMENTS U.S. Department of Energy

SUBJECT TOX

COMMENT 2. EPA requests comment on whether various types of spent lamps (e.g, incandescent, neon), other than mercury-containing lamps, typically fail the TC test or exhibit other hazardous waste characteristics, which TC constituents fail and how frequently (59 38296). In comments submitted to EPA on April 12, 1993, DOE explained that incandescent lamps generally fail the toxicity characteristic test for lead by the TCLP method because of their lead soldered bases and leaded glass. High-intensity discharge lamps, some of which do not contain mercury, also generally fail the toxicity characteristic test for lead by the TCLP method because of their lead soldered bases. Also, test results for DOE's Paducah facility show that all types of incandescent bulbs tested failed the TCLP for lead, and 3 out of 5 types tested failed for cadmium as well. Data from DOE's Mixed Waste Inventory Report (see Exhibit 1) showed that DOE's Oak Ridge K-25 site has an incandescent bulb mixed waste stream that fails the TC test for mercury and cadmium. RCRA codes were conservatively assigned to all of the waste streams shown on Exhibit 1 based on process knowledge. Additional process knowledge, or sampling and analysis, may determine that some of the codes listed on the exhibit are unnecessary.

RESPONSE

The Agency appreciates the commenter's submission of information on the characterization of

spent lamps. These data can be used by the commenter and others as a basis for making hazardous waste determinations without testing all lamps. EPA studies have also determined that, in addition to mercury, some spent lamps fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or exhibit any hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to LDR standards before disposal, unless they are recycled. The Agency notes that most incandescent lamps are generated by households or CESQGs and thus are not fully regulated under Subtitle C, pursuant to 40 CFR 261.4(b) and 261.5.

DCN SCSP-00131

COMMENTS Monsanto

SUBJECT TOX

COMMENT Recent data from the National Electrical Manufacturers

Association indicate that, more often than not, spent fluorescent bulbs exhibit the toxicity characteristic for mercury. Discussions with Union Electric Company in St. Louis and with other chemical manufacturers indicates similar findings in analytical work that they have performed. Also, in a regulatory interpretation letter it was stated that "Recent data from generators of spent fluorescent bulbs and [NEMA] indicate that more often than not, spent fluorescent bulbs exhibit the [TC] for mercury (i.e., equal or exceed the TCLP regulatory level of 0.2 mg/L). Thus, it is likely that generators of this waste will reach a determination that spent fluorescent bulbs are a hazardous waste." (May 11, 1992, from David M. Webster, RCRA Policy Lead for Region I, to William C. Osborn of Lighting Recycling, Inc. (Brookline, Mass.))

RESPONSE

The Agency appreciates the information on lamp toxicity submitted by the commenter. These data can be used by the commenter and others as a basis for making hazardous waste determinations without testing all lamps. EPA studies have also determined that the majority of spent lamps fail the TCLP for mercury and that some spent lamps also fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit a hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). The Agency

notes that generators of waste are not required to test their waste to determine if it is hazardous waste and may apply their knowledge of the waste to make a hazardous waste determination.

DCN SCSP-00137

COMMENTER Utility Solid Waste Activities Group

SUBJECT TOX

COMMENT I. Lighting Wastes Do Not Warrant Hazardous Waste Regulation.

As an initial matter, USWAG believes that mercury-containing lighting wastes do not warrant regulation as hazardous wastes. We understand that recent studies from the Office of Solid Wastes Technical Assessment and Waste Characterization Branches indicate that mercury is not as mobile in the subsurface environment as previously suspected and that, in fact, the current TC regulatory level of 0.2 mg/L for mercury is overly conservative and inappropriately characterizes mercury-containing lighting wastes as hazardous wastes. Specifically, we understand that recent revisions to the metal speciation model ("MINTEQ") indicate that mercury (in addition to other metals) is relatively immobile in the subsurface environment and that corresponding leachate analyses show no mercury present. [4] [Footnote 4: In fact, EPA expressly acknowledged in the preamble to the TC rule that it would re-examine the technical issues associated with the subsurface fate and transport of metals and that it planned to promulgate specific dilution attenuation factors ("DAFs") for individual metals which, in turn, would result in amending the corresponding TC regulatory levels. See 55 Fed. Reg. 11798, 11813 (March 29, 1990).] This point was reiterated in a recent EPA letter to the states regarding the regulatory status of lighting wastes, wherein the Agency conceded that "[e]vidence from municipal landfills indicates that the regulatory levels for mercury may need to be revised." [5] [Footnote 5: See EPA letter from Don Clay, Assistant Administrator for Solid Waste and Emergency Response and Michael Shapiro, Deputy Assistant Administrator for Air and Radiation, to Leigh Pegues, Director, Department of Environmental Services, Montgomery, AL, dated December 7, 1992. Copies of this letter were reportedly sent to all state environmental regulators (Attachment A).] [See hard copy of Comment SCSP-00137 Attachment]. EPA also stated that "lamps can generally be managed safely without keeping them under the umbrella of hazardous waste regulation" and that the "advantages of energy efficient lighting are clear and ...

compelling, regardless of the regulatory status of lamp wastes, whether at the federal or State levels." Id. In short, EPA's data indicate that the current TC regulatory levels for certain metals, particularly mercury, are overly conservative and that mercury-containing lighting wastes are being inappropriately and unnecessarily swept into the Subtitle C hazardous waste system.

#### RESPONSE

While at one point the Agency may have suggested, in a preliminary manner certainly not rising to the level of Agency action, that the mercury TC level might be too conservative, such that lamps might be safely managed outside the Subtitle C framework, this is no longer EPA's view. The most recent data available to the Agency suggest, indeed demonstrate, greater mobility of mercury than was implied in the 1992 letter cited by the commenter. These data include updated groundwater modeling, as well as field data collected by the Agency in reviewing the hazardous characteristics generally, the TCLP test, and CERCLA Records of Decision (RODs) from municipal solid waste landfills. EPA no longer believes that management of hazardous waste lamps outside of the Subtitle C framework is protective of human health and the environment. As explained in more detail in other comment responses and elsewhere in the record, these data expand upon and corroborate data cited in the proposal that mercury can migrate from municipal solid waste landfills in harmful concentrations and reach human drinking water sources located miles from the landfill in significant concentrations (i.e., concentrations exceeding allowable mercury in drinking water). Thus, the commenter's qualitative suggestions to the contrary are not correct.

The Agency notes that today's final rule provides regulatory relief and that spent lamps are no longer required to be managed under the full Subtitle C management standards. Today's rule adds hazardous waste lamps (i.e., spent lamps that fail the TCLP for any hazardous constituent, or that exhibit a hazardous waste characteristic) to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. EPA studies have determined that the majority of spent lamps fail the TCLP for mercury and that some spent lamps also fail the TCLP for lead.

The Agency does not have extensive data characterizing the behavior of mercury released from spent lamps in a landfill environment over long periods of time, although the available data show that mercury can be and has been released to the groundwater or air in concentrations that can and have posed significant risk to humans and other environmental receptors (contrary to the commenter's largely speculative statements). Studies on the evaluation of the fate and transport of TC metals (including mercury) in this context are still ongoing. As pointed out by the commenter, these analyses include additional development and validation of the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. However, because these studies are not complete, the Agency has not come to any final conclusions about the need to revise the TC regulation for mercury. The current TC regulation

may be intentionally conservative in some respects (see 55 FR 11800, March 29, 1990) but not in other respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, EPA 1997).

EPA notes that the December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L for mercury and a slightly more protective point on the probability distribution curve for well contamination at the MCL concentration (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value, although this analysis indicates it might be reduced.

Because of significant commenter interest in the leaching and groundwater fate and transport of mercury in landfills, the Agency has reviewed two readily and publicly available data sources on the release of mercury to groundwater from landfills, and also preliminary results of an ongoing Agency study on landfill leachate. The first data source is the 1996 Hazardous Waste Characteristics Scoping Study in which the Agency identified verified releases of chemicals (including mercury) from industrial non-hazardous and construction and demolition landfills. The second data source is a set of Records of Decision (RODs) created by the CERCLA program in studying contaminated sites and developing remedies for the sites. RODs that identified mercury as a site contaminant, and municipal landfills as the source or potential source of contamination were examined. This review of CERCLA RODs expands and updates the Agency's examination of RODs from 1990 and 1991 done for the mercury lamps proposal (59 FR 38291). The preliminary data are from an ongoing study of landfill leachate in which the Agency is collecting leachate contaminant concentrations (including mercury) at several types of operating and closed landfills.

The Scoping Study identified 112 cases where release of contaminants from industrial non-hazardous waste management could be verified and release data were available. Most sites had verified data because state-supervised remediation had been or was being conducted at the site; data were available from public state files. Of the 112 cases identified, 19 (17%) identified mercury releases, primarily to groundwater. Either state or federal regulatory standards were exceeded in 6 of the 19 cases (32%, or 5% of the total cases; 5 cases exceeded federal or state MCLs; one exceeded a soil clean-up value). Only general data on the waste disposed in these units were available, although several locations with MCL exceedences received paper mill sludges.



The Agency also reviewed additional data in CERCLA RODS dating from 1985 through 1997 to see whether mercury releases have occurred at MSW landfills where remediation was required. Of the 1211 current sites on the NPL, 82 are identified by SIC code as MSW landfills. Approximately 150 NPL sites (total) include *landfill* or *dump* in their name, and which, on examination of their RODs, were found to have accepted MSW during their operating life. Of these, mercury was detected at 39 sites (26% of MSW sites; 51 RODs-- some sites have multiple RODs). Mercury concentrations in groundwater or surface water exceeded the MCL at five sites clearly identified as MSW units, and the MCL was exceeded at two more units that were not identified as MSW landfills by SIC code. Two RODs identified residential drinking water wells as sampling locations, one with mercury far above the MCL, and one with mercury equal to the MCL at the well, at distances up to one and a half miles from the source of contamination. Five more facilities had groundwater or surface water contaminated with mercury at 10% or more of the MCL concentration. Data on waste disposed in these landfills were not available.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time-span. The RODs discussed in the mercury lamps proposal concerned only municipal solid waste disposal sites and date only from 1990 and 1991. In that review, the Agency identified mercury as a constituent of concern at 12 of 66 sites that received municipal solid waste. Of these, five sites had wells contaminated with mercury at concentrations above the MCL. While the Agency did not view the ROD data at proposal as an indication that significant amounts of mercury are being released from MSW landfills, data from the expanded and updated RODs analysis show that this preliminary conclusion was not correct, and that mercury contamination of groundwater from landfills is more widespread than previously believed. However, even the original RODs review discussed in the proposal indicated that mercury does leach from MSW landfills. However, the Agency noted that four of the five sites also received industrial waste, and focused only on data from the remaining site. The data from that site showed on-site mercury concentrations above the MCL and off-site groundwater samples below detection limits for mercury. It is apparent that the hasty inference from one site that mercury contamination will not spread off-site was unwarranted.

Finally, as part of its efforts to review the TCLP test and its application in the RCRA programs, the Agency has collected data on landfill leachate composition for MSW, industrial D, and hazardous waste landfills. Preliminary analysis of the MSW landfill data from the study identified mercury (total) in 10/170 leachate samples, with the median mercury concentration (where mercury was found) at 40% of the MCL (0.0008 mg/l), and the 90<sup>th</sup> percentile value 30 times the MCL concentration, or at 30% of the toxicity characteristic value (0.061 mg/l). The hazardous waste landfill leachate showed higher mercury concentrations, and the industrial, non-hazardous landfills showed lower mercury concentrations in the leachate.

These data clearly show that the TCLP test and the dilution/attenuation factor used for mercury in the toxicity characteristic rule are at best only slightly conservative for mercury, and do not grossly overestimate mercury leaching and groundwater fate and transport. They show very clearly that

mercury can be leached from waste and released to the groundwater at levels that are significant to the environment, from several landfill types, including MSW landfills. In MSW landfill leachate, mercury at 30% of the toxicity characteristic value indicates that the TCLP test may be somewhat, but not excessively conservative. Mercury in groundwater at levels exceeding the MCL indicates clearly that mercury can not only leach from waste but can also be transported at environmentally significant concentrations in groundwater. Given these data, the Agency's preliminary conclusion that mercury is not being readily leached from MSW landfills appears to be unfounded.

These data could be used to update the analysis of mercury releases from landfills in the RTI report, and would undoubtedly show an increased rate of release compared with EPA's 1992 analysis. However, and more significantly, these data show not only mercury releases at higher concentrations in the leachate, they also show environmentally significant levels of mercury in groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate that a significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.

The regulatory requirements of the universal waste rule applicable to handlers and transporters of universal waste are less complex than the full Subtitle C regulations. Universal waste handlers who generate or manage items designated as universal waste may choose to follow streamlined standards for storing universal waste, labeling and marking waste or containers, preparing and sending shipments of universal wastes off-site, employee training, and response to releases. Universal waste transporters must comply with all applicable Department of Transportation regulations and ensure transportation of universal waste to a universal waste handler or a destination facility. Transporters of universal waste do not have to comply with the RCRA hazardous waste manifest requirements or obtain an EPA identification number (as hazardous waste transporter) as long as they travel through states that consider hazardous waste lamps to be

a universal waste. However, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) remain subject to all Subtitle C management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities.

DCN FLEP-00142

COMMENTS The Fertilizer Institute

SUBJECT TOX

COMMENTS Waste characterization costs add to the high cost of Subtitle C management. The procedure for determining whether a mercury-containing lamp exhibits the Toxicity Characteristic is expensive and, more importantly, unreliable. In this regard, in 1991 the National Electrical Manufacture Association (NEMA) conducted a survey in which mercury-containing lamps were sent to different laboratories for analysis of the mercury content. NEMA found that: - spent lamps often fail the Toxicity Characteristic test, but the variable test data are inconclusive - analytical results differ with lamp type - there are considerable laboratory-to-laboratory variations in analytical results EPA's contractor, Science Applications International Corporation (SAIC), echoed NEMA's findings in a 1992 study entitled, "Analytical Results of Mercury-Containing Fluorescent Lamps" (May 15, 1992) at pp. 2-3. Given the variability in mercury levels from lamp to lamp, a generator may not be able to rely on a laboratory analysis of a "representative" spent fluorescent bulb to determine the regulatory status of all spent bulbs generated by the facility. Arguably, a generator must test every batch of spent bulbs to determine their regulatory status (or, worse yet, test every bulb).

#### RESPONSE

The Agency notes that generators of waste are not required to test their waste to determine if the waste is hazardous and may instead apply their knowledge of the waste to make the hazardous waste determination. There is by this time a large body of TCLP test data on which the commenter could rely (see, e.g., *Analytical Results of Mercury in Fluorescent Lamps*, Science Applications International Inc. (SAIC), 1992)). EPA studies have also determined that the majority of spent lamps fail the TCLP for mercury and that some spent lamps also fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards).

There are many reasons for variability in TCLP test results for mercury lamps. These include variation in design and manufacturing practices and lamp age and condition at the time of disposal. The 1992 SAIC study was the Agency's initial response to variability in TCLP results that may be attributed to TCLP test design. The report suggested a solution to the most significant factor in the TCLP design that caused variable results for lamps **B** the requirement to use a 100 gram sample of waste. The suggested protocol adjustment to account for the debris-like nature of lamps was to conduct a TCLP leach test on the whole lamp, not a sub-sample. In addition, EPA has worked with NEMA over the intervening time to assess additional sample preparation refinements suggested by NEMA that can reduce variability in TCLP test results.

DCN SCSP-00146

COMMENTS Advanced Environmental Recycling Corp.

SUBJECT TOX

COMMENT In a high majority of cases, fluorescent lamps are a hazardous waste based on TCLP testing. Although through the past several years, there have been concerns about the validity of a TCLP test for mercury contained in lamps, it is the only true means we have, at this point, to quantify the amount of leachable mercury contained in a fluorescent lamp. Science Applications International Corporation's (SAIC's) May 15, 1992 report, Analytical Results of Mercury in Fluorescent Lamps, detailed a standard procedure for lamp preparation prior to conducting the standard TCLP test.

RESPONSE

EPA studies have determined that the majority of spent lamps fail the TCLP for mercury, and agrees with the commenter that proper performance of the procedure will help ensure consistent results for spent lamps. EPA studies have also determined that some spent lamps fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards).

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addition, EPA has worked with NEMA over the intervening time to assess additional sample preparation refinements suggested by NEMA that can reduce variability in TCLP test results.

DCN FLEP-00156

COMMENTS National Electrical Manufacturers Assn.

SUBJECT TOX

COMMENT NEMA also found that glass from spent lamps can pass the TCLP and still contain significant levels of mercury, demonstrating that the TCLP is not the appropriate test for determining the safety of reclaimed lamp materials. NEMA believes that there are significant issues associated with the re-use of materials recovered from lamps and that the best means to control them is to ensure either that the mercury has been removed from the materials to below the level of detection using an appropriate mercury totals analytical procedure, or that the materials will not be subjected to processes involving the application of heat unless mercury emissions are controlled. Our BMPs and regulatory language describe in more detail how these regulatory provisions would work.

#### RESPONSE

The Agency appreciates the information submitted by the commenter on mercury present in spent lamps and lamp glass. EPA studies have also determined that the majority of spent lamps fail the TCLP for mercury and that some spent lamps also fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards).

Regarding the TCLP test, the test has been upheld as a means of identifying metal-containing solid wastes as hazardous. When the Agency promulgated the TCLP method for testing whether wastes exhibit the toxicity characteristic, the applicability of the TCLP test to mineral processing wastes was challenged in Edison Electric Institute v. EPA, 2 F.3d 438, 444-45 (D.C. Cir. 1993) (Edison). The Court ruled in Edison that applying the TCLP test to mineral processing wastes is appropriate if the evidence available to EPA shows that disposing of such wastes in municipal solid waste landfills (MSWLF) is a "plausible" mismanagement scenario (not necessarily a typical or common scenario), 2 F.3d at 446. Moreover, the Court found that it is sufficient if there is evidence or explanation on the record to justify a conclusion that mineral wastes ever come into contact with any form of acidic leaching medium. Id. at 447. A significant amount of data has been submitted to the Agency indicating that a widespread current practice is to dispose of spent mercury-containing lamps in municipal solid waste landfills, so this is clearly a reasonable disposal

scenario to model. Disposal of an industrial waste in such landfills, and the risk to groundwater resulting from that disposal, is the scenario that EPA sought to incorporate into the TCLP test and TC regulation. As at proposal, EPA continues to believe that the mobility and fate and transport features of the TC (i.e., the leaching procedure and the fate and transport assumptions built into the regulatory limit) are reasonable for mercury-containing lamps, given that 1) mercury will be mobilized from the lamps when the lamps are crushed after disposal in landfill cells; 2) mercury is in a leachate and water-soluble form in lamps; and 3) monitoring data from MSWLFs confirm mercury can and has escaped from landfill units, causing extensive environmental contamination.

The universal waste rule includes storage and packaging standards for handlers of mercury lamps to ensure the proper management of spent lamps and to prevent uncontrolled and unintentional breakage during storage and transport to the recycling or treatment facility. The Agency notes that today's rule does not change any regulatory requirements applicable to destination facilities (i.e., recycling facilities and treatment and disposal facilities). Under today's rule, those facilities are subject to all Subtitle C management requirements applicable to hazardous waste treatment and disposal facilities, although the Agency does not regulate the actual process of reclaiming mercury. In addition, recycling facilities (as well as downstream facilities that reuse the recycled products) must comply with all applicable Clean Air Act requirements, all applicable worker safety standards under the Occupational Safety and Health Administration (OSHA) and all applicable state controls (including possible best management practices or other controls on the recycling process).

In EPA's 1997 Mercury Emissions Study, the Agency estimated the emissions of mercury under current lamp management and the universal waste and conditional exclusion regulatory options, and included emissions from recycling operations for each option. Table 3-2 of the study indicates that even though recycling is projected to increase over current practice and the conditional exclusion option, total mercury emissions from lamps to air are likely to decrease.

Residuals from recovery operations must also be managed in accordance with all applicable solid and hazardous waste management requirements. If residuals exhibit a characteristic of hazardous waste, they must be managed in accordance with all applicable hazardous waste management controls, including the requirements of 40 CFR Subpart C, standards for recyclable materials used in a manner constituting disposal.

DCN FLEP-00160

COMMENTS Central and South West Services, Inc.

SUBJECT TOX

COMMENT Supporting this position is the Agency's ongoing work on the metal speciation model ("MINTEQ"), which indicates that mercury (in addition to other metals) is relatively immobile in the subsurface environment and that corresponding leachate analysis

shows no mercury present. (Fn. 1 - In fact, EPA expressly acknowledged in the preamble to the TC rule that it would re-examine the technical issues associated with the subsurface fate and transport of metals and that it planned to promulgate specific dilution attenuation factors (DAFs) for individual metals which, in turn, would result in amending the corresponding TC regulatory levels. See 55 Fed Reg 11789, 11813 (March 29, 1990)). In light of this growing volume of data, the Agency correctly acknowledges that "the regulatory limits for mercury if re-assessed using the MINTEQ model, when completed, might be higher (less stringent) than the current limits because mercury may be less mobile than the current TC rule indicates."

Id. This point was reiterated in a recent EPA letter to the states regarding the regulatory status of lighting wastes, wherein the Agency conceded that "[e]vidence from municipal landfills indicates that the regulatory levels for mercury may need to be revised." (Fn. 2 - See EPA letter from Don Clay, Assistant Administrator for Solid Waste and Emergency Response and Michael Shapiro, Deputy Assistant Administrator for Air and Radiation, to Leigh Pegues, Director, Department of Environmental Services, Montgomery, AL, dated December 7, 1992. Copies of this letter were reportedly sent to all state environmental regulators.) EPA also stated in that letter that "lamps can generally be managed safely without keeping them under the umbrella of hazardous waste regulation." Id. The record evidence in this rulemaking confirms this position. In short, the existing record indicates that the current TC regulatory levels for certain metals, particularly mercury, are overly conservative and that mercury-containing lighting wastes are being inappropriately and unnecessarily swept into the Subtitle C hazardous waste system. The net result is that the regulated community -- including companies participating in the Green Lights and other energy-efficient relamping programs -- are unnecessarily being subjected to a costly regulatory program for materials that do not warrant hazardous waste regulation. These findings alone provide a compelling and legally defensible rationale for finding that mercury-containing lighting wastes do not warrant hazardous waste regulation.

#### RESPONSE

EPA's preliminary view, as expressed in the 1992 letter cited by the commenter, was that lamps might be safely managed outside of Subtitle C framework if data eventually showed that mercury was relatively immobile and incapable of migrating from MSWLFs. However, the most recent

data available to the Agency suggest greater mobility of mercury than was implied in the 1992 letter. These data include updated groundwater modeling, as well as field data collected by the Agency in reviewing the hazardous characteristics generally, the TCLP test, and CERCLA Records of Decision (RODs) from municipal solid waste landfills. EPA no longer believes that management of hazardous waste lamps outside of the Subtitle C framework is protective of human health and the environment.

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

However, because these studies of mercury in groundwater are not complete, the Agency has not come to any final conclusions about the need to revise the TC regulation for mercury. The current TC regulation may be intentionally conservative in some respects (see 55 FR 11800, March 29, 1990), but not in other respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, volume 1, pp. 2-1 to 2-9; 3-8 to 3-22, and volume 3, EPA 1997). Today's final rulemaking does not change the current regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP).

As described in detail in other comment responses, empirical data from CERCLA NPL sites involving MSWLFs, as well as other sources, demonstrate that mercury is indeed mobile and capable of migrating from MSWLFs to cause significant harm. These data corroborate and expand upon the data EPA cited at proposal that lamps disposed in MSWLFs can release harmful amounts of mercury to the ambient environment via leaching to groundwater (given that mercury will escape from the waste matrix when lamps are crushed in the landfill cell, and is present in lamps in mobile form, as explained in earlier responses and elsewhere in the record).

EPA studies have determined that the majority of spent lamps exceed the TC limit for mercury. In addition, studies have shown that some spent lamps fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit a hazardous waste characteristic are



subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards).

The regulatory approach finalized today will not affect participation in energy-efficient lighting programs such as EPA's Green Lights Program. Studies have shown that participation in energy-efficient lighting programs reduces potential mercury (as well as other pollutant) air emissions associated with the burning of fossil fuels for electricity generation.

DCN FLEP-00162

COMMENTS Delaware Department of Natural Resources

SUBJECT TOX

COMMENT PRECEDENCE CW EXCLUDING A WASTE THAT FAILS THE TCLP

Delaware is concerned with the consequences if the U.S. EPA implements an exclusion for mercury containing lamps. The U.S. EPA would be setting a potentially harmful precedence by excluding a waste that fails the Toxicity Characteristic Leachate Procedure (TCLP). The Delaware HWMB believes an exclusion of this nature would raise questions and doubts among the regulated industry for other mercury containing wastes which are currently regulated as hazardous waste. Further, an exclusion would question the validity of utilizing TCLP methodologies in making waste determinations.

RESPONSE

The Agency thanks the commenter for submitting comments on the proposed rule and shares some of the commenter's concerns. In today's final rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Today's rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to LDR standard before disposal, unless they are recycled.

DCN FLEP-00177

COMMENTS Philips Lighting Company

SUBJECT TOX

COMMENT We encourage the EPA to continue work on both the MINTEQ model and the study of air emissions.

RESPONSE

EPA notes that the Agency published a Notice of Data Availability on July 11, 1997 (62 FR 37183). This notice presented data collected by the Agency and an assessment of potential mercury emissions from the management of hazardous waste lamps under several regulatory approaches. In addition to these analyses, the Agency is continuing to develop and validate the MINTEQ model and its applications for determining the fate and transport of hazardous metals. However, as explained elsewhere, the final rule includes real world data which corroborate fate and transport predictions made by the MINTEQ model, demonstrating that mercury from MSWLFs can and has escaped from waste matrices, migrated from landfills and caused substantial contamination of the ambient environment.

DCN SCSP-00181

COMMENTS General Electric Company

SUBJECT TOX

COMMENT The situation with fluorescent lamps differs significantly from this scenario. While lamps have some similarities to batteries in their distribution patterns among regulated and non-regulated generators, there is considerable evidence demonstrating that fluorescent lamps should not be regulated as hazardous waste. Lamps only recently came under Subtitle C coverage when EPA changed from the Extraction Procedure ("EP") to the more aggressive Toxic Characteristic Leaching Procedure ("TCLP") for identifying characteristic mercury wastes, and there are serious questions about the ability of the TCLP to measure the true disposal risks associated with lamps. In particular, as discussed below, the EPACML model used to predict migration of metal species through the subsurface grossly overestimates mercury migration from fluorescent lamps.

RESPONSE

EPA notes that a possible misunderstanding by the commenter needs to be clarified. The TCLP test alone does not measure the disposal risk associated with wastes. Rather, the TCLP test, along with estimated dilution and attenuation in groundwater and the MCL (or health endpoint) for a chemical, together constitute the toxicity characteristic regulation. The TC regulation does identify as hazardous those wastes that are likely to pose significant risks to human health and the environment via a groundwater exposure pathway, if the wastes are mismanaged.

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372),

MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve for well contamination (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value, and might even result in more stringent regulation.

Because of significant commenter interest in the leaching and groundwater fate and transport of mercury in landfills, the Agency has reviewed two readily and publicly available data sources on the release of mercury to groundwater from landfills, and also preliminary results of an ongoing Agency study on landfill leachate. The first data source is the 1996 Hazardous Waste Characteristics Scoping Study in which the Agency identified verified releases of chemicals (including mercury) from industrial non-hazardous and construction and demolition landfills. The second data source is a set of Records of Decision (RODs) created by the CERCLA program in studying contaminated sites and developing remedies for the sites. RODs that identified mercury as a site contaminant, and municipal landfills as the source or potential source of contamination were examined. This review of CERCLA RODs expands and updates the Agency's examination of RODs from 1990 and 1991 done for the mercury lamps proposal (59 FR 38291). The preliminary data are from an ongoing study of landfill leachate in which the Agency is collecting leachate contaminant concentrations (including mercury) at several types of operating and closed landfills.

The Scoping Study identified 112 cases where release of contaminants from industrial non-hazardous waste management could be verified and release data were available. Most sites had verified data because state-supervised remediation had been or was being conducted at the site; data were available from public state files. Of the 112 cases identified, 19 (17%) identified mercury releases, primarily to groundwater. Either state or federal regulatory standards were exceeded in 6 of the 19 cases (32%, or 5% of the total cases; 5 cases exceeded federal or state MCLs; one exceeded a soil clean-up value). Only general data on the waste disposed in these units were available, although several locations with MCL exceedences received paper mill sludges.

The Agency also reviewed additional data in CERCLA RODS dating from 1985 through 1997 to see whether mercury releases have occurred at MSW landfills where remediation was required. Of the 1211 current sites on the NPL, 82 are identified by SIC code as MSW landfills. Approximately 150 NPL sites (total) include landfill or dump in their name, and which, on examination of their RODs, were found to have accepted MSW during their operating life. Of these, mercury was detected at 39 sites (26% of MSW sites; 51 RODs-- some sites have multiple RODs). Mercury concentrations in groundwater or surface water exceeded the MCL at five sites clearly identified as MSW units, and the MCL was exceeded at two more units that were not

identified as MSW landfills by SIC code. Two RODs identified residential drinking water wells as sampling locations, one with mercury far above the MCL, and one with mercury equal to the MCL at the well, at distances up to one and a half miles from the source of contamination. Five more facilities had groundwater or surface water contaminated with mercury at 10% or more of the MCL concentration. Data on waste disposed in these landfills were not available.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time-span. The RODs discussed in the mercury lamps proposal concerned only municipal solid waste disposal sites and date only from 1990 and 1991. In that review, the Agency identified mercury as a constituent of concern at 12 of 66 sites that received municipal solid waste. Of these, five sites had wells contaminated with mercury at concentrations above the MCL. While the Agency did not view the ROD data at proposal as an indication that significant amounts of mercury are being released from MSW landfills, data from the expanded and updated RODs analysis show that this preliminary conclusion was not correct, and that mercury contamination of groundwater from landfills is more widespread than previously believed.

However, even the original RODs review discussed in the proposal indicated that mercury does leach from MSW landfills. However, the Agency noted that four of the five sites also received industrial waste, and focused only on data from the remaining site. The data from that site showed on-site mercury concentrations above the MCL and off-site groundwater samples below detection limits for mercury. It is apparent that the hasty inference from one site that mercury contamination will not spread off-site was unwarranted.

Finally, as part of its efforts to review the TCLP test and its application in the RCRA programs, the Agency has collected data on landfill leachate composition for MSW, industrial D, and hazardous waste landfills. Preliminary analysis of the MSW landfill data from the study identified mercury (total) in 10/170 leachate samples, with the median mercury concentration (where mercury was found) at 40% of the MCL (0.0008 mg/l), and the 90<sup>th</sup> percentile value 30 times the MCL concentration, or at 30% of the toxicity characteristic value (0.061 mg/l). The hazardous waste landfill leachate showed higher mercury concentrations, and the industrial, non-hazardous landfills showed lower mercury concentrations in the leachate.

These data clearly show that the TCLP test and the dilution/attenuation factor used for mercury in the toxicity characteristic rule are at best only slightly conservative for mercury, and do not grossly overestimate mercury leaching and groundwater fate and transport. They show very clearly that mercury can be leached from waste and released to the groundwater at levels that are significant to the environment, from several landfill types, including MSW landfills. In MSW landfill leachate, mercury at 30% of the toxicity characteristic value indicates that the TCLP test may be somewhat, but not excessively conservative. Mercury in groundwater at levels exceeding the MCL indicates clearly that mercury can not only leach from waste but can also be transported at environmentally significant concentrations in groundwater. Given these data, the Agency's preliminary conclusion that mercury is not being readily leached from MSW landfills appears to be unfounded.

These data could be used to update the analysis of mercury releases from landfills in the RTI report, and would undoubtedly show an increased rate of release compared with EPA's 1992 analysis. However, and more significantly, these data show not only mercury releases at higher concentrations in the leachate, they also show environmentally significant levels of mercury in groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate that a significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.

Today's final rulemaking has not changed the regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP). EPA studies have determined that the majority of spent lamps exceed this limit for mercury (see, e.g., *Analytical Results of Mercury in Fluorescent Lamps*, Science Applications International Inc. (SAIC), 1992)). In addition, studies have shown that some spent lamps fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). The Agency may at some future time reevaluate how it regulates mercury-bearing wastes, including lamps, but is not doing a comprehensive reevaluation of mercury regulation today.

The current TC regulation may be intentionally conservative in some respects (see 55 FR 11800, March 29, 1990) but not in other respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, volume 1, pp. 2-1 to 2-9; 3-8 to 3-22, and volume 3, EPA 1997). Today's final rulemaking does

not change the current regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP).

Regarding the TCLP test, the test has been upheld as a means of identifying metal-containing solid wastes as hazardous. When the Agency promulgated the TCLP method for testing whether wastes exhibit the toxicity characteristic, the applicability of the TCLP test to mineral processing wastes was challenged in Edison Electric Institute v. EPA, 2 F.3d 438, 444-45 (D.C. Cir. 1993) (Edison). The Court ruled in Edison that applying the TCLP test to mineral processing wastes is appropriate if the evidence available to EPA shows that disposing of such wastes in municipal solid waste landfills (MSWLF) is a "plausible" mismanagement scenario (not necessarily a typical or common scenario), 2 F.3d at 446. Moreover, the Court found that it is sufficient if there is evidence or explanation on the record to justify a conclusion that mineral wastes ever come into contact with any form of acidic leaching medium. @ Id. at 447. A significant amount of data has been submitted to the Agency indicating that a widespread current practice is to dispose of spent mercury-containing lamps in municipal solid waste landfills, so this is clearly a reasonable disposal scenario to model. Disposal of an industrial waste in such landfills, and the risk to groundwater resulting from that disposal, is the scenario that EPA sought to incorporate into the TCLP test and TC regulation. As at proposal, EPA continues to believe that the mobility and fate and transport features of the TC (i.e., the leaching procedure and the fate and transport assumptions built into the regulatory limit) are reasonable for mercury-containing lamps, given that 1) mercury will be mobilized from the lamps when the lamps are crushed after disposal in landfill cells; 2) mercury is in a leachate and water-soluble form in lamps; and 3) monitoring data from MSWLFs confirm mercury can and has escaped from landfill units, causing extensive environmental contamination.

Application of the TCLP to evaluate the hazardous waste status of lamps is therefore supported by evidence of current disposal practices. Therefore, it is the Agency's conclusion that, in the case of hazardous waste lamps, the conditions set forth in Edison are met, and using the TCLP to determine whether such lamps are hazardous waste is supported both by legal precedent and fact. NEMA has provided some data to the Agency indicating that lamps may not have failed the EP Toxicity test. However, in the few studies of mercury leaching conducted in development of the TCLP, mercury leaching was more likely to be underestimated than overestimated (see the report entitled *Field and Laboratory Studies in Support of a Hazardous Waste Extraction Test*, Oak Ridge National Laboratory, in the RCRA docket for the TC rule, docket number F-86-TC-50014). In addition, we repeat that use of the TC is supported by updated groundwater modeling as well as field data collected by the Agency in reviewing the hazardous characteristics generally, the TCLP test, and CERCLA Records of Decision (RODs) from municipal solid waste landfills.

DCN SCSP-00181

COMMENTS General Electric Company

SUBJECT TOX

COMMENT Therefore, based on MSW's significant capacity for retaining mercury in the landfill, the insignificant concentration of

mercury in MSW leachate, and the overestimation of leachable mercury in used lamps, it is evident that the modeling assumption underlying the TCLP are inappropriate for characterizing fluorescent lamps as hazardous waste. Thus, EPA should exclude fluorescent lamps from the definition of hazardous waste based on the findings presented in EPA's study.

#### RESPONSE

The Agency does not have extensive data characterizing the behavior of mercury released from spent lamps in a landfill environment over long periods of time, but available data show that mercury can be, and has been released into groundwater and air from municipal landfills. Studies on the evaluation of the fate and transport of TC metals (including mercury in this context) are still ongoing. These analyses include additional development and validation of the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. However, because these studies are not complete, the Agency has not come to any final conclusions about the need to revise the TC regulation for mercury. The current TC regulation may be intentionally conservative in some respects (see 55 FR 11800, March 29, 1990), but not in other respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, EPA 1997). Today's final rulemaking does not change the current regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP).

EPA studies have determined that the majority of spent lamps fail the TCLP for mercury and that some spent lamps also fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or exhibit any hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards).

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mercury-containing lamps in municipal solid waste landfills, so this is clearly a reasonable disposal scenario to model. Disposal of an industrial waste in such landfills, and the risk to groundwater resulting from that disposal, is the scenario that EPA sought to incorporate into the TCLP test and TC regulation. As at proposal, EPA continues to believe that the mobility and fate and transport features of the TC (i.e., the leaching procedure and the fate and transport assumptions built into the regulatory limit) are reasonable for mercury-containing lamps, given that 1) mercury will be mobilized from the lamps when the lamps are crushed after disposal in landfill cells; 2) mercury is in a leachate and water-soluble form in lamps; and 3) monitoring data from MSWLFs confirm mercury can and has escaped from landfill units, causing extensive environmental contamination.

Application of the TCLP to evaluate the hazardous waste status of lamps is therefore supported by evidence of current disposal practices. Therefore, it is the Agency's conclusion that, in the case of hazardous waste lamps, the conditions set forth in Edison are met, and using the TCLP to determine whether such lamps are hazardous waste is supported both by legal precedent and fact. NEMA has provided some data to the Agency indicating that lamps may not have failed the EP Toxicity test. However, in the few studies of mercury leaching conducted in development of the TCLP, mercury leaching was more likely to be underestimated than overestimated (see the report entitled *Field and Laboratory Studies in Support of a Hazardous Waste Extraction Test*, Oak Ridge National Laboratory, in the RCRA docket for the TC rule, docket number F-86-TC-50014). In addition, use of the TC is supported by updated groundwater modeling as well as field data collected by the Agency in reviewing the hazardous characteristics generally, the TCLP test, and CERCLA Records of Decision (RODs) from municipal solid waste landfills. Thus, the commenter is demonstrably incorrect in its references to "MSW mercury retention capability" and insignificant concentrations of mercury in MSW leachate.

As for the commenter's assertion that EPA has overestimated leachable mercury used in lamps, there is no clear, conclusive data on the environmental impacts to groundwater specifically from mercury lamps in landfills. All field studies identified by the Agency to date have tried to assess total mercury behavior (from all sources) in landfills and estimated lamp impact in proportion to national average lamp contribution to total mercury in the landfill. There are no field studies of the differential impact of mercury lamp disposal in MSWLFs compared with other mercury waste, such as would be needed to support the commenter's assertion.

Mercury from lamps may in fact pose a proportionately higher risk to groundwater than other mercury going to MSWLFs. The major source of mercury to MSWLFs is batteries (see Table 4-1 of the RTI report, p. 78). However, because of battery construction (i.e., use of metal casing around the battery and binders to solidify and hold battery chemicals in place), the mercury in batteries disposed in MSWLFs today may not become available for years. Other mercury in MSWLFs comes from thermostats, paints, and dental materials. This mercury may be relatively unavailable to leach from MSWLFs. Elemental mercury, such as that found in thermostats and thermometers, is quite water insoluble and thermostats may not break easily in MSWLF disposal.



Mercury in paint is likely to be bound in paint resins, and not released until the resins break down. Dental mercury is usually amalgamated with silver and other metals, another relatively stable form of mercury. Mercury from lamps, on the other hand, may be quite available. Mercury lamps are universally broken, either before, during, or after MSWLF disposal, and the mercury is released to the landfill.

Also, a high proportion of mercury from lamps is believed to be in the divalent ionic form, not elemental (see page 2-4, Table 2-2 of the 1997 Emissions Study). Ionic mercury is the most likely form of mercury to be leached, since it can be solublized in water, as well as by the more aggressive landfill leachate. The degree to which this occurs in any particular MSWLF depends largely on the particular MSWLF conditions, including availability of anions (such as chlorine or sulfur) that might form relatively soluble or insoluble salts of mercury, and also the reducing potential of the MSWLF that could convert the divalent mercury back to elemental mercury (and which can also facilitate formation of methyl mercury). Again, however, EPA certainly cannot make the assumption that every MSWLF will contain sufficient sulfide to bind up all the mercury in disposed lamps. Rather, the assumption in the rule that there is not an infinite source of binding agents in MSWLFs is prudent, reasonable, and (as detailed below and in other comments) amply justified by the data showing significant concentrations of mercury leaching from wastes in MSWLFs and posing significant risk to human health and the environment.

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve for well contamination (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value, and might even result in more stringent regulation.

Because of significant commenter interest in the leaching and groundwater fate and transport of mercury in landfills, the Agency has reviewed two readily and publicly available data sources on the release of mercury to groundwater from landfills, and also preliminary results of an ongoing Agency study on landfill leachate. The first data source is the 1996 Hazardous Waste Characteristics Scoping Study in which the Agency identified verified releases of chemicals (including mercury) from industrial non-hazardous and construction and demolition landfills. The

second data source is a set of Records of Decision (RODs) created by the CERCLA program in studying contaminated sites and developing remedies for the sites. RODs that identified mercury as a site contaminant, and municipal landfills as the source or potential source of contamination were examined. This review of CERCLA RODs expands and updates the Agency's examination of RODs from 1990 and 1991 done for the mercury lamps proposal (59 FR 38291). The preliminary data are from an ongoing study of landfill leachate in which the Agency is collecting leachate contaminant concentrations (including mercury) at several types of operating and closed landfills.

The Scoping Study identified 112 cases where release of contaminants from industrial non-hazardous waste management could be verified and release data were available. Most sites had verified data because state-supervised remediation had been or was being conducted at the site; data were available from public state files. Of the 112 cases identified, 19 (17%) identified mercury releases, primarily to groundwater. Either state or federal regulatory standards were exceeded in 6 of the 19 cases (32%, or 5% of the total cases; 5 cases exceeded federal or state MCLs; one exceeded a soil clean-up value). Only general data on the waste disposed in these units were available, although several locations with MCL exceedences received paper mill sludges.

The Agency also reviewed additional data in CERCLA RODS dating from 1985 through 1997 to see whether mercury releases have occurred at MSW landfills where remediation was required. Of the 1211 current sites on the NPL, 82 are identified by SIC code as MSW landfills. Approximately 150 NPL sites (total) include *landfill* or *dump* in their name, and which, on examination of their RODs, were found to have accepted MSW during their operating life. Of these, mercury was detected at 39 sites (26% of MSW sites; 51 RODs-- some sites have multiple RODs). Mercury concentrations in groundwater or surface water exceeded the MCL at five sites clearly identified as MSW units, and the MCL was exceeded at two more units that were not identified as MSW landfills by SIC code. Two RODs identified residential drinking water wells as sampling locations, one with mercury far above the MCL, and one with mercury equal to the MCL at the well, at distances up to one and a half miles from the source of contamination. Five more facilities had groundwater or surface water contaminated with mercury at 10% or more of the MCL concentration. Data on waste disposed in these landfills were not available.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time-span. The RODs discussed in the mercury lamps proposal concerned only municipal solid waste disposal sites and date only from 1990 and 1991. In that review, the Agency identified mercury as a constituent of concern at 12 of 66 sites that received municipal solid waste. Of these, five sites had wells contaminated with mercury at concentrations above the MCL. While the Agency did not view the ROD data at proposal as an indication that significant amounts of mercury are being released from MSW landfills, data from the expanded and updated RODs analysis show that this preliminary conclusion was not correct, and that mercury contamination of groundwater from landfills is more widespread than previously believed.

However, even the original RODs review discussed in the proposal indicated that mercury does leach from MSW landfills. However, the Agency noted that four of the five sites also received industrial waste, and focused only on data from the remaining site. The data from that site showed on-site mercury concentrations above the MCL and off-site groundwater samples below detection limits for mercury. It is apparent that the hasty inference from one site that mercury contamination will not spread off-site was unwarranted.

Finally, as part of its efforts to review the TCLP test and its application in the RCRA programs, the Agency has collected data on landfill leachate composition for MSW, industrial D, and hazardous waste landfills. Preliminary analysis of the MSW landfill data from the study identified mercury (total) in 10/170 leachate samples, with the median mercury concentration (where mercury was found) at 40% of the MCL (0.0008 mg/l), and the 90<sup>th</sup> percentile value 30 times the MCL concentration, or at 30% of the toxicity characteristic value (0.061 mg/l). The hazardous waste landfill leachate showed higher mercury concentrations, and the industrial, non-hazardous landfills showed lower mercury concentrations in the leachate.

These data clearly show that the TCLP test and the dilution/attenuation factor used for mercury in the toxicity characteristic rule are at best only slightly conservative for mercury, and do not grossly overestimate mercury leaching and groundwater fate and transport. They show very clearly that mercury can be leached from waste and released to the groundwater at levels that are significant to the environment, from several landfill types, including MSW landfills. In MSW landfill leachate, mercury at 30% of the toxicity characteristic value indicates that the TCLP test may be somewhat, but not excessively conservative. Mercury in groundwater at levels exceeding the MCL indicates clearly that mercury can not only leach from waste but can also be transported at environmentally significant concentrations in groundwater. Given these data, the Agency's preliminary conclusion that mercury is not being readily leached from MSW landfills appears to be unfounded.

These data could be used to update the analysis of mercury releases from landfills in the RTI report, and would undoubtedly show an increased rate of release compared with EPA's 1992 analysis. However, and more significantly, these data show not only mercury releases at higher concentrations in the leachate, they also show environmentally significant levels of mercury in groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate that a significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.

DCN FLEP-00187

COMMENTS PacifiCorp

SUBJECT TOX

COMMENT 1.The Existing TC Mischaracterizes Lighting Wastes.

EPA concedes that the existing regulatory levels for mercury under the Toxicity Characteristic ("TC") regulation may overestimate the leaching potential of mercury and that, in fact, the current TC regulatory level of 0.2 mg/L for mercury may be overly conservative and may inappropriately characterize mercury-containing wastes as hazardous. *Id.* at 38289. In particular, EPA studies and the Agency's ongoing work on the metal speciation model ("MINTEQ") indicate that mercury is not as mobile in the subsurface environment as previously suspected and "that mercury that would leach out of landfills would not all necessarily travel far enough through the groundwater to contaminate drinking water wells, depending on the distance to the well." *Id.* The Agency thus correctly acknowledges that "the regulatory limits for mercury if re-assessed using the MINTEQ model, when completed, might be higher (less stringent) than the current limits because mercury may be less mobile than the current TC rule indicates." *Id.* This point was reiterated in a recent EPA letter to the states regarding the regulatory status of lighting wastes, wherein the Agency conceded that "[e]vidence from municipal landfills indicates that the regulatory levels for mercury may need to be revised." [1] [Footnote 1: See EPA letter from Don Clay, Assistant Administrator for Solid Waste and Emergency Response and Michael Shapiro, Deputy Assistant Administrator for Air and Radiation, to Leigh Pegues, Director, Department of Environmental Services, Montgomery, AL, dated December 7, 1992.] EPA also stated in that letter that "lamps can generally be managed safely without keeping them under the umbrella of hazardous waste regulation." *Id.* In short, the existing record contains no basis for sweeping mercury-containing lighting wastes into the Subtitle C hazardous

waste system. The regulated community, including companies participating in the Green Lights and other energy- efficient relamping programs, is therefore unnecessarily being subjected to a costly regulatory program.

#### RESPONSE

EPA's preliminary view, as expressed in the 1992 letter cited by the commenter was that lamps might be safely managed outside of the Subtitle C framework if data eventually showed that mercury was relatively immobile and incapable of migrating from MSWLFs. However, the most recent data available to the Agency suggest greater mobility of mercury than was implied in the 1992 letter. These data include updated groundwater modeling, as well as field data collected by the Agency in reviewing the hazardous characteristics generally, the TCLP test, and CERCLA Records of Decision (RODs) from municipal solid waste landfills. EPA no longer believes that management of hazardous waste lamps outside of the Subtitle C framework is protective of human health and the environment.

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

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Finally, as part of its efforts to review the TCLP test and its application in the RCRA programs, the Agency has collected data on landfill leachate composition for MSW, industrial D, and hazardous waste landfills. Preliminary analysis of the MSW landfill data from the study identified mercury (total) in 10/170 leachate samples, with the median mercury concentration (where mercury was found) at 40% of the MCL (0.0008 mg/l), and the 90<sup>th</sup> percentile value 30 times the MCL concentration, or at 30% of the toxicity characteristic value (0.061 mg/l). The hazardous waste landfill leachate showed higher mercury concentrations, and the industrial, non-hazardous landfills showed lower mercury concentrations in the leachate.

These data clearly show that the TCLP test and the dilution/attenuation factor used for mercury in the toxicity characteristic rule are at best only slightly conservative for mercury, and do not grossly overestimate mercury leaching and groundwater fate and transport. They show very clearly that mercury can be leached from waste and released to the groundwater at levels that are significant to the environment, from several landfill types, including MSW landfills. In MSW landfill leachate, mercury at 30% of the toxicity characteristic value indicates that the TCLP test may be somewhat, but not excessively conservative. Mercury in groundwater at levels exceeding the MCL indicates clearly that mercury can not only leach from waste but can also be transported at environmentally significant concentrations in groundwater. Given these data, the Agency's preliminary conclusion that mercury is not being readily leached from MSW landfills appears to be unfounded.

These data could be used to update the analysis of mercury releases from landfills in the RTI report, and would undoubtedly show an increased rate of release compared with EPA's 1992 analysis. However, and more significantly, these data show not only mercury releases at higher concentrations in the leachate, they also show environmentally significant levels of mercury in groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate

that a significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.

However, because studies to assess mercury using MINTEQ and CMTP are not complete, the Agency has not come to any final conclusions about the need to revise the TC regulation for mercury. The current TC regulation may be intentionally conservative in some respects (see 55 FR 11800, March 29, 1990), but not in all respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, EPA 1997).

Today's final rulemaking has not changed the regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP). EPA studies have determined that the majority of spent lamps exceed this limit for mercury. In addition, studies have shown that some spent lamps fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit a hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). The Agency may at some future time reevaluate how it regulates mercury-bearing wastes, including lamps, but is not doing a comprehensive reevaluation of mercury regulation today.

Regarding the TCLP test, the test has been upheld as a means of identifying metal-containing solid wastes as hazardous. When the Agency promulgated the TCLP method for testing whether wastes exhibit the toxicity characteristic, the applicability of the TCLP test to mineral processing wastes was challenged in Edison Electric Institute v. EPA, 2 F.3d 438, 444-45 (D.C. Cir. 1993) (Edison). The Court ruled in Edison that applying the TCLP test to mineral processing wastes is appropriate if the evidence available to EPA shows that disposing of such wastes in municipal solid waste landfills (MSWLF) is a "plausible" mismanagement scenario (not necessarily a typical or common scenario), 2 F.3d at 446. Moreover, the Court found that it is sufficient if there is evidence or explanation on the record to justify a conclusion that mineral wastes ever come into contact with any form of acidic leaching medium. @ Id. at 447. A significant amount of data has been submitted to the Agency indicating that a widespread current practice is to dispose of spent mercury-containing lamps in municipal solid waste landfills, so this is clearly a reasonable disposal scenario to model. Disposal of an industrial waste in such landfills, and the risk to groundwater resulting from that disposal, is the scenario that EPA sought to incorporate into the TCLP test and TC regulation. As at proposal, EPA continues to believe that the mobility and fate and transport features of the TC (i.e., the leaching procedure and the fate and transport assumptions built into the regulatory limit) are reasonable for mercury-containing lamps, given that 1) mercury will be mobilized from the lamps when the lamps are crushed after disposal in landfill cells; 2) mercury is in a leachate and water-soluble form in lamps; and 3) monitoring data from MSWLFs



confirm mercury can and has escaped from landfill units, causing extensive environmental contamination.

Application of the TCLP to evaluate the hazardous waste status of lamps is therefore supported by evidence of current disposal practices. The fate and transport features of the Toxicity Characteristic are likewise not only supported by the modeling cited in the proposed rule, but corroborated empirically based on environmental measurements of mercury released from MSWLFs.

The universal waste rule will not affect participation in energy-efficient lighting programs. Many commenters indicated that savings from reduced energy usage more than covers the cost of managing lamps as hazardous waste.

DCN FLEP-00191

COMMENTS Utility Solid Waste Activities Group

SUBJECT TOX

COMMENT Continued application of the toxicity characteristic leaching procedure ("TCLP") to mercury-containing lamps is arbitrary and capricious because there is no rational connection between the TCLP and the environmental impacts associated with the management of mercury-containing lamps in MSWLFs. Indeed, in light of the overwhelming record evidence that the management of such materials in MSWLFs does not pose a threat to human health and the environment and EPA's recognition that the toxicity characteristic leaching procedure ("TCLP") does not accurately portray the behavior of mercury in the MSWLF environment, the continued regulation of mercury-containing lamps under the Subtitle C program would fly in the face of the record evidence and would be arbitrary and capricious.

This conclusion is consistent with EPA's reassessment of the mercury TC regulatory level which, as discussed below, indicates that mercury is not as mobile in the subsurface environment as previously suspected (see 59 Fed. Reg. at 38239) and that the current TC regulatory level of 0.2 mg/L is overly conservative and inappropriately characterizes mercury-containing lighting wastes as hazardous. Having opened the issue of whether mercury-containing lamps should be regulated as hazardous waste, the Agency may not now ignore the compelling evidence that these lamps do not pose a threat to human health or the environment when managed in MSWLFs and thus do not meet the statutory definition of hazardous waste.

In short, the evidence shows conclusively that mercury-containing lamps do not pose a threat to human health or the environment when managed in MSWLFs and thus do not meet the statutory definition of a hazardous waste. RCRA ' 1004(5), 42 U.S.C. ' 6903(5). Accordingly, the continued regulation of these materials under the hazardous waste program would fly in the face of the record evidence and would be arbitrary and capricious. C. Continued Application of the TCLP to Mercury-Containing Lamps Would Be Arbitrary and Capricious The data in the rulemaking record also makes clear that EPA cannot continue to subject mercury-containing lamps to the toxicity characteristic leaching procedure because there is no rational relationship between the TCLP -- and the accompanying toxicity characteristic (TC") regulatory level for mercury -- and the environmental impacts associated with managing lamps in MSWLFs. The D.C. Circuit has made clear that, to pass muster under the Administrative Procedure Act ("APA"), the TCLP must bear some "rational relationship" to the wastes in question "in order for the Agency to justify the application of the toxicity test to those wastes." *Edison Electric Institute v. United States Environmental Protection Agency*, 2 F.3d 438, 446 (D.C. Cir. 1993), citing *Motor Vehicle Mfrs. Ass'n v. State Farm*, 463 US. 29, 43 (1983). In that case, the Court found that the application of the TCLP to mineral processing wastes violated the APA because the Agency had "failed to demonstrate any such relationship on the record" (i.e., between the mismanagement scenario underlying the TCLP and the actual management practices associated with mineral processing wastes). *Id.* The record evidence in this rulemaking makes clear that there is a similar "disconnect" between the fundamental assumptions underlying the TCLP and the actual environmental impact of managing mercury-containing lamps in MSWLFs. Because there is not a "rational relationship" between the TCLP and the management of mercury-containing lamps in MSWLFs, the Agency is not justified in continuing to subject these wastes to the TCLP. Specifically, the TC regulatory levels are predicated upon the assumptions that the TC constituent of concern will (1) readily leach from a municipal solid waste landfill and migrate through the subsurface environment and (2) reach a potential drinking water source at concentrations above a specified health-based level (in the case of mercury, the maximum contaminant level of 0.002 mg/L). See 55 Fed. Reg. 11798, 11812-27 (March 29, 1990) The

record evidence in this rulemaking, however, completely refutes both of these assumptions in the case of mercury-containing lamps. First, EPA itself concedes that "the preliminary data and analysis suggest at this time that mercury in municipal solid wastes is not being readily released by leaching processes that typically occur in the MSW landfill environment." 59 Fed. Reg. at 38291. [2] [Footnote 2: This conclusion is supported "by controlled leaching studies of high- concentration mercury-containing wastes co-disposed with municipal solid waste (Borden et al., 1990/Gould et al., 1988)." Id.] Therefore, one of the fundamental underpinnings of the TC regulatory levels -- that constituents leach from MSWLFs at elevated levels due to the aggressive leaching media present in such landfills (55 Fed. Reg. at 11807) -- is not applicable in the case of mercury-containing lamps. Second, as discussed in detail above, the minimal amount of leaching of mercury from lamps that has been detected at MSWLFs will not result in the contamination of groundwater at levels exceeding the MCL for mercury; indeed, the majority of data did not detect any measurable level of contamination due to the management of bulbs in MSWLFs. See 59 Fed. Reg. at 38293 ("The available data on landfill leachate suggest that mercury-containing lamps may not pose a threat to groundwater when placed in a state-controlled municipal landfill due to the low levels of mercury found in landfill leachate."). Therefore, the second key assumption underlying the TCLP and the associated TC regulatory level for mercury -- that mercury leachate will reach drinking water receptors at levels above the MCL -- has also been completely refuted in the case of mercury-containing lamps.

Therefore, the continued application of the TCLP to mercury-containing lamps would be arbitrary and capricious. *Edison Electric Institute v. EPA*, 2 F.3d at 446.

#### RESPONSE

Application of the TCLP to mercury lamps is not arbitrary and capricious, because there is a firm, rational connection between common lamp mismanagement (i.e., disposal in a municipal solid waste landfill) and the fundamental basis of the TCLP test **B** to estimate industrial waste constituent leaching under conditions simulating critical parameters present in a municipal solid waste landfill (MSWLF). The TCLP test has never been purported to be a precise measure of actual leaching of all wastes under all disposal conditions, even all MSWLFs. No single leach test or model could incorporate precise estimates for the many variables that may affect waste leaching. The TCLP did attempt to incorporate the most critical variables for MSWLFs, the acid

type and pH range present when MSWLFs are actively decomposing (55 FR 11800; March 29, 1990).

The TCLP test is also acknowledged by the Agency to represent a "reasonable worst case" (55 FR 11800, 11806). In acknowledging this, the Agency recognized that no single test could be precise for all circumstances and made a conscious policy choice to err on the side of providing additional environmental protection. In choosing a single test, the Agency also recognized that allowing test variation to match particular disposal conditions would create a hazardous waste identification system that would be nearly impossible to enforce, and so rejected this approach.

Also, the commenter's statement that because "lamps do not pose a threat to human health and the environment when managed in MSWLFs" they do not meet the statutory definition of a hazardous waste misinterprets the statute. "Safe" management in a MSWLF (even if true) is not the statutory test of which wastes are hazardous; other waste mismanagement scenarios are certainly possible. MSWLF disposal is the basis for the TCLP test, and as noted, the test contains some conservative assumptions. However, there are significant aspects of the environmental hazards posed by mercury that the TCLP test and the TC rule do not account for or include. Among these are the ability of mercury to be transported long distances through the air and the significant potential to bioaccumulate.

The commenter also asserts that there is no rational relationship between the TCLP/TC and the environmental impacts of managing mercury lamps in a MSWLF. This is a surprising assertion, because there is no clear, conclusive data on the environmental impacts to groundwater specifically from mercury lamps in landfills. All field studies identified by the Agency to date have tried to assess total mercury behavior (from all sources) in landfills and estimated lamp impact in proportion to national average lamp contribution to total mercury in the landfill. There is, therefore, no basis for the commenter's assumption, and it may in fact be quite incorrect. There are no field studies of the differential impact of mercury lamp disposal in MSWLFs compared with other mercury waste, such as would be needed to support the commenter's assertion. Mercury from lamps may in fact pose a proportionately higher risk to groundwater than other mercury going to MSWLFs. The major source of mercury to MSWLFs is batteries (see Table 4-1 of the RTI report, p. 78). However, because of battery construction (i.e., use of metal casing around the battery and binders to solidify and hold battery chemicals in place), the mercury in batteries disposed in MSWLFs today may not become available for years. Other mercury in MSWLFs comes from thermostats, paints, and dental materials. This mercury may be relatively unavailable to leach from MSWLFs. Elemental mercury, such as that found in thermostats and thermometers, is quite water insoluble and thermostats may not break easily in MSWLF disposal. Mercury in paint is likely to be bound in paint resins, and not released until the resins break down. Dental mercury is usually amalgamated with silver and other metals, another relatively stable form of mercury. Mercury from lamps, on the other hand, may be quite available. Mercury lamps are universally broken, either before, during, or after MSWLF disposal, and the mercury is released to the landfill.

Given that lamps comprise the second largest source of mercury in MSWLFs (see RTI study Table 4-1), the commenter's conclusory assertion that mercury from lamps would pose an insignificant part of mercury contributions to landfill leachate is not warranted. The commenter's assumption lacks merit for the additional reason that a high proportion of mercury from lamps is believed to be in the divalent ionic form, not elemental (see page 2-4, Table 2-2 of the 1997 Emissions Study). Ionic mercury is the most likely form of mercury to be leached, since it can be solubilized in water, as well as by the more aggressive landfill leachate. The degree to which this occurs in any particular MSWLF depends largely on the particular MSWLF conditions, including availability of anions (such as chlorine or sulfur) that might form relatively soluble or insoluble salts of mercury, and also the reducing potential of the MSWLF that could convert the divalent mercury back to elemental mercury (and which can also facilitate formation of methyl mercury). Again, however, EPA certainly cannot make the assumption that every MSWLF will contain sufficient sulfide to bind up all the mercury in disposed lamps. Rather, the assumption in the rule that there is not an infinite source of binding agents in MSWLFs is prudent, reasonable, and (as detailed below and in other comments) amply justified by the data showing significant concentrations of mercury leaching from wastes in MSWLFs and posing significant risk to human health and the environment.

The commenter also asserts that there is a disconnect between the TCLP for lamps and the impact to the environment that is analogous to the disconnect found by the Court in *Edison Electric Institute v. U.S. EPA* regarding the use of the TCLP to evaluate mineral processing waste. No such analogy exists. The Court found that the Agency had not demonstrated that mineral processing waste ever goes to MSWLF disposal, and lacking such a demonstration, the TCLP would not apply. As discussed above, the Agency has clearly demonstrated that MSWLF disposal is the predominant actual mismanagement scenario for lamps.

Further, the commenter mischaracterizes the TCLP/TC rules in asserting that they assume constituents will be readily leached and migrate to a drinking water well at concentrations above the MCL for mercury. The TCLP test assumes only that waste will be exposed to one of the organic acids present when MSWLFs are actively decomposing, and to enough water to bring soluble constituents into solution. The dilution/attenuation factor (DAF) of 100 assumes there will be substantial dilution as contaminated groundwater leaves the MSWLF and moves toward a drinking water well. While the value of 100 for the DAF for metals is taken from the EP toxicity rule, and metals were not specifically modeled for the TC rule, the value agrees well with the modeling done for the infinite source type of non-degrading organic chemicals added in the TC rule. A DAF of 134 was estimated for all non-degrading constituents at the 85% protectiveness level, rounded to a DAF of 100 for all TC constituents in the final regulation; see 55 FR 11826-11827, March 29, 1990. This modeling does have conservative assumptions included in it. One notable conservative aspect is that the probabilistic modeling was run at an 85<sup>th</sup> percentile protectiveness level. This means that the Agency believed that at the TC regulatory levels, approximately 85% of MSWLFs would not have nearby wells contaminated. The Agency would therefore not expect, and was in fact trying to prevent, well contamination above the drinking

water MCLs.

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

Because of significant commenter interest in the leaching and groundwater fate and transport of mercury in landfills, the Agency has reviewed two readily and publicly available data sources on the release of mercury to groundwater from landfills, and also preliminary results of an ongoing Agency study on landfill leachate. The first data source is the 1996 Hazardous Waste Characteristics Scoping Study in which the Agency identified verified releases of chemicals (including mercury) from industrial non-hazardous and construction and demolition landfills. The second data source is a set of Records of Decision (RODs) created by the CERCLA program in studying contaminated sites and developing remedies for the sites. RODs that identified mercury as a site contaminant, and municipal landfills as the source or potential source of contamination were examined. This review of CERCLA RODs expands and updates the Agency's examination of RODs from 1990 and 1991 done for the mercury lamps proposal (59 FR 38291). The preliminary data are from an ongoing study of landfill leachate in which the Agency is collecting leachate contaminant concentrations (including mercury) at several types of operating and closed landfills.

The Scoping Study identified 112 cases where release of contaminants from industrial non-hazardous waste management could be verified and release data were available. Most sites had verified data because state-supervised remediation had been or was being conducted at the site; data were available from public state files. Of the 112 cases identified, 19 (17%) identified mercury releases, primarily to groundwater. Either state or federal regulatory standards were exceeded in 6 of the 19 cases (32%, or 5% of the total cases; 5 cases exceeded federal or state MCLs; one exceeded a soil clean-up value). Only general data on the waste disposed in these units were available, although several locations with MCL exceedences received paper mill sludges.

The Agency also reviewed additional data in CERCLA RODS dating from 1985 through 1997 to see whether mercury releases have occurred at MSW landfills where remediation was required. Of the 1211 current sites on the NPL, 82 are identified by SIC code as MSW landfills. Approximately 150 NPL sites (total) include *landfill* or *dump* in their name, and which, on examination of their RODs, were found to have accepted MSW during their operating life. Of these, mercury was detected at 39 sites (26% of MSW sites; 51 RODs-- some sites have multiple RODs). Mercury concentrations in groundwater or surface water exceeded the MCL at five sites clearly identified as MSW units, and the MCL was exceeded at two more units that were not identified as MSW landfills by SIC code. Two RODs identified residential drinking water wells as sampling locations, one with mercury far above the MCL, and one with mercury equal to the MCL at the well, at distances up to one and a half miles from the source of contamination. Five more facilities had groundwater or surface water contaminated with mercury at 10% or more of the MCL concentration. Data on waste disposed in these landfills were not available.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time-span. The RODs discussed in the mercury lamps proposal concerned only municipal solid waste disposal sites and date only from 1990 and 1991. In that review, the Agency identified mercury as a constituent of concern at 12 of 66 sites that received municipal solid waste. Of these, five sites had wells contaminated with mercury at concentrations above the MCL. While the Agency did not view the ROD data at proposal as an indication that significant amounts of mercury are being released from MSW landfills, data from the expanded and updated RODs analysis show that this preliminary conclusion was not correct, and that mercury contamination of groundwater from landfills is more widespread than previously believed. However, even the original RODs review discussed in the proposal indicated that mercury does leach from MSW landfills. However, the Agency noted that four of the five sites also received industrial waste, and focused only on data from the remaining site. The data from that site showed on-site mercury concentrations above the MCL and off-site groundwater samples below detection limits for mercury. It is apparent that the hasty inference from one site that mercury contamination will not spread off-site was unwarranted.

Finally, as part of its efforts to review the TCLP test and its application in the RCRA programs, the Agency has collected data on landfill leachate composition for MSW, industrial D, and hazardous waste landfills. Preliminary analysis of the MSW landfill data from the study identified mercury (total) in 10/170 leachate samples, with the median mercury concentration (where mercury was found) at 40% of the MCL (0.0008 mg/l), and the 90<sup>th</sup> percentile value 30 times the MCL concentration, or at 30% of the toxicity characteristic value (0.061 mg/l). The hazardous waste landfill leachate showed higher mercury concentrations, and the industrial, non-hazardous landfills showed lower mercury concentrations in the leachate.

These data clearly show that the TCLP test and the dilution/attenuation factor used for mercury in the toxicity characteristic rule are at best only slightly conservative for mercury, and do not grossly overestimate mercury leaching and groundwater fate and transport. They show very clearly that

mercury can be leached from waste and released to the groundwater at levels that are significant to the environment, from several landfill types, including MSW landfills. In MSW landfill leachate, mercury at 30% of the toxicity characteristic value indicates that the TCLP test may be somewhat, but not excessively conservative. Mercury in groundwater at levels exceeding the MCL indicates clearly that mercury can not only leach from waste but can also be transported at environmentally significant concentrations in groundwater. Given these data, the Agency's preliminary conclusion that mercury is not being readily leached from MSW landfills appears to be unfounded.

These data could be used to update the analysis of mercury releases from landfills in the RTI report, and would undoubtedly show an increased rate of release compared with EPA's 1992 analysis. However, and more significantly, these data show not only mercury releases at higher concentrations in the leachate, they also show environmentally significant levels of mercury in groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate that a significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.

Because these studies of mercury in groundwater are not complete, the Agency has not come to any final conclusions about the need to revise the TC regulation for mercury. While the current TC regulation may be conservative in some regards (as it was intended to be; See 55 FR 11800, 3/29/90), there are also significant aspects in which mercury TC regulation is not conservative. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, EPA 1997).

Today's final rulemaking has not changed the regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP). EPA studies have determined that the majority of spent lamps exceed this limit for



mercury. In addition, studies have shown that some spent lamps fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or exhibit a hazardous waste characteristic are subject to today's final rule. The final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). The Agency may at some future time reevaluate how it regulates mercury-bearing wastes, including lamps, but is not doing a comprehensive reevaluation of mercury regulation today.

Regarding the TCLP test, the test has been upheld as a means of identifying metal-containing solid wastes as hazardous. When the Agency promulgated the TCLP method for testing whether wastes exhibit the toxicity characteristic, the applicability of the TCLP test to mineral processing wastes was challenged in Edison Electric Institute v. EPA, 2 F.3d 438, 444-45 (D.C. Cir. 1993) (Edison). The Court ruled in Edison that applying the TCLP test to mineral processing wastes is appropriate if the evidence available to EPA shows that disposing of such wastes in municipal solid waste landfills (MSWLF) is a "plausible" mismanagement scenario (not necessarily a typical or common scenario), 2 F.3d at 446. Moreover, the Court found that it is sufficient if there is evidence or explanation on the record to justify a conclusion that mineral wastes ever come into contact with any form of acidic leaching medium. @ Id. at 447. A significant amount of data has been submitted to the Agency indicating that a widespread current practice is to dispose of spent mercury-containing lamps in municipal solid waste landfills, so this is clearly a reasonable disposal scenario to model. Disposal of an industrial waste in such landfills, and the risk to groundwater resulting from that disposal, is the scenario that EPA sought to incorporate into the TCLP test and TC regulation. As at proposal, EPA continues to believe that the mobility and fate and transport features of the TC (i.e., the leaching procedure and the fate and transport assumptions built into the regulatory limit) are reasonable for mercury-containing lamps, given that 1) mercury will be mobilized from the lamps when the lamps are crushed after disposal in landfill cells; 2) mercury is in a leachate and water-soluble form in lamps; and 3) monitoring data from MSWLFs confirm mercury can and has escaped from landfill units, causing extensive environmental contamination.

Application of the TCLP to evaluate the hazardous waste status of lamps is therefore supported by evidence of current disposal practices. Therefore, it is the Agency's conclusion that, in the case of hazardous waste lamps, the conditions set forth in Edison are met, and using the TCLP to determine whether such lamps are hazardous waste is supported both by legal precedent and fact.

DCN FLEP-00195

COMMENTS South Carolina Electric and Gas Company

SUBJECT TOX

COMMENT We realize the importance of reducing the amount of waste being sent to landfills. Our testing of mercury-containing shows that

they generally do not fail TCLP for mercury. Even EPA's data indicates that mercury does not leach from MSWLFs at levels that would pose a threat to the environment.

#### RESPONSE

EPA studies have determined that the majority of spent lamps fail the TCLP for mercury and that some spent lamps also fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to LDR standards before disposal, unless they are recycled. However, it is the waste generator's obligation to determine whether a waste is hazardous or not. The data cited by the commenter may be used to support such a determination.

The Agency does not have extensive data characterizing the behavior of mercury released from spent lamps in a landfill environment over long periods of time, although the available data show that mercury can be, and has been released to groundwater and air from municipal landfills. Studies on the evaluation of the fate and transport of TC metals (including mercury) in this context are still ongoing. These analyses include additional development and validation of the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. However, because these studies are not complete, the Agency has not come to any final conclusions about the need to revise the TC regulation for mercury. The current TC regulation may be intentionally conservative in some respects (see 55 FR 11800, March 29, 1990), but not in other respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, EPA 1997). Today's final rulemaking does not change the current regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP).

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far

from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

Because of significant commenter interest in the leaching and groundwater fate and transport of mercury in landfills, the Agency has reviewed two readily and publicly available data sources on the release of mercury to groundwater from landfills, and also preliminary results of an ongoing Agency study on landfill leachate. The first data source is the 1996 Hazardous Waste Characteristics Scoping Study in which the Agency identified verified releases of chemicals (including mercury) from industrial non-hazardous and construction and demolition landfills. The second data source is a set of Records of Decision (RODs) created by the CERCLA program in studying contaminated sites and developing remedies for the sites. RODs that identified mercury as a site contaminant, and municipal landfills as the source or potential source of contamination were examined. This review of CERCLA RODs expands and updates the Agency's examination of RODs from 1990 and 1991 done for the mercury lamps proposal (59 FR 38291). The preliminary data are from an ongoing study of landfill leachate in which the Agency is collecting leachate contaminant concentrations (including mercury) at several types of operating and closed landfills.

The Scoping Study identified 112 cases where release of contaminants from industrial non-hazardous waste management could be verified and release data were available. Most sites had verified data because state-supervised remediation had been or was being conducted at the site; data were available from public state files. Of the 112 cases identified, 19 (17%) identified mercury releases, primarily to groundwater. Either state or federal regulatory standards were exceeded in 6 of the 19 cases (32%, or 5% of the total cases; 5 cases exceeded federal or state MCLs; one exceeded a soil clean-up value). Only general data on the waste disposed in these units were available, although several locations with MCL exceedences received paper mill sludges.

The Agency also reviewed additional data in CERCLA RODS dating from 1985 through 1997 to see whether mercury releases have occurred at MSW landfills where remediation was required. Of the 1211 current sites on the NPL, 82 are identified by SIC code as MSW landfills. Approximately 150 NPL sites (total) include landfill or dump in their name, and which, on examination of their RODs, were found to have accepted MSW during their operating life. Of these, mercury was detected at 39 sites (26% of MSW sites; 51 RODs-- some sites have multiple RODs). Mercury concentrations in groundwater or surface water exceeded the MCL at five sites clearly identified as MSW units, and the MCL was exceeded at two more units that were not identified as MSW landfills by SIC code. Two RODs identified residential drinking water wells as sampling locations, one with mercury far above the MCL, and one with mercury equal to the MCL at the well, at distances up to one and a half miles from the source of contamination. Five more facilities had groundwater or surface water contaminated with mercury at 10% or more of the MCL concentration. Data on waste disposed in these landfills were not available.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time-span. The RODs discussed in the mercury lamps proposal concerned

only municipal solid waste disposal sites and date only from 1990 and 1991. In that review, the Agency identified mercury as a constituent of concern at 12 of 66 sites that received municipal solid waste. Of these, five sites had wells contaminated with mercury at concentrations above the MCL. While the Agency did not view the ROD data at proposal as an indication that significant amounts of mercury are being released from MSW landfills, data from the expanded and updated RODs analysis show that this preliminary conclusion was not correct, and that mercury contamination of groundwater from landfills is more widespread than previously believed. However, even the original RODs review discussed in the proposal indicated that mercury does leach from MSW landfills. However, the Agency noted that four of the five sites also received industrial waste, and focused only on data from the remaining site. The data from that site showed on-site mercury concentrations above the MCL and off-site groundwater samples below detection limits for mercury. It is apparent that the hasty inference from one site that mercury contamination will not spread off-site was unwarranted.

Finally, as part of its efforts to review the TCLP test and its application in the RCRA programs, the Agency has collected data on landfill leachate composition for MSW, industrial D, and hazardous waste landfills. Preliminary analysis of the MSW landfill data from the study identified mercury (total) in 10/170 leachate samples, with the median mercury concentration (where mercury was found) at 40% of the MCL (0.0008 mg/l), and the 90<sup>th</sup> percentile value 30 times the MCL concentration, or at 30% of the toxicity characteristic value (0.061 mg/l). The hazardous waste landfill leachate showed higher mercury concentrations, and the industrial, non-hazardous landfills showed lower mercury concentrations in the leachate.

These data clearly show that the TCLP test and the dilution/attenuation factor used for mercury in the toxicity characteristic rule are at best only slightly conservative for mercury, and do not grossly overestimate mercury leaching and groundwater fate and transport. They show very clearly that mercury can be leached from waste and released to the groundwater at levels that are significant to the environment, from several landfill types, including MSW landfills. In MSW landfill leachate, mercury at 30% of the toxicity characteristic value indicates that the TCLP test may be somewhat, but not excessively conservative. Mercury in groundwater at levels exceeding the MCL indicates clearly that mercury can not only leach from waste but can also be transported at environmentally significant concentrations in groundwater. Given these data, the Agency's preliminary conclusion that mercury is not being readily leached from MSW landfills appears to be unfounded.

These data could be used to update the analysis of mercury releases from landfills in the RTI report, and would undoubtedly show an increased rate of release compared with EPA's 1992 analysis. However, and more significantly, these data show not only mercury releases at higher concentrations in the leachate, they also show environmentally significant levels of mercury in groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation

of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate that a significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.

DCN FLEP-00204

COMMENTS American Lamp Recycling, Ltd.

SUBJECT TOX

COMMENTS The Agency's apparent rationale for the presentation of option 1 is that the current Toxicity Characteristic (TC) for mercury is overly stringent and that the total mass of mercury released to the environment from mercury-containing lamps is not significant. First, if the Agency believes the TC for mercury should be relaxed, then the agency should proceed with data acquisition and study to the point where it has assured itself that an increase in the characteristic level is protective of human health and the environment and issue a proposed rule amending 40 CFR 261.24, not begin excluding individual waste streams.

#### RESPONSE

The Agency thanks the commenter for submitting comments on the proposed rule. In today's final rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Today's rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to LDR standards before disposal, unless they are recycled.

EPA studies have determined that the majority of spent lamps fail the TCLP for mercury, and sometimes for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule.

The Agency does not have extensive data characterizing the behavior of mercury released from spent lamps in a landfill environment over long periods of time, although the available data show that mercury can be, and has been released to groundwater and air from municipal landfills. Studies on the evaluation of the fate and transport of TC metals (including mercury) in this context are still ongoing. These analyses include additional development and validation of the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. However, because these studies are not complete, the Agency has not come to any conclusions about the need to revise the TC regulation for mercury. The current TC regulation may be intentionally conservative in some respects (see 55 FR 11800, March 29, 1990), but not in other respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, EPA 1997). Today's final rulemaking does not change the current regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP).

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

Because of significant commenter interest in the leaching and groundwater fate and transport of mercury in landfills, the Agency has reviewed two readily and publicly available data sources on the release of mercury to groundwater from landfills, and also preliminary results of an ongoing Agency study on landfill leachate. The first data source is the 1996 Hazardous Waste Characteristics Scoping Study in which the Agency identified verified releases of chemicals (including mercury) from industrial non-hazardous and construction and demolition landfills. The second data source is a set of Records of Decision (RODs) created by the CERCLA program in studying contaminated sites and developing remedies for the sites. RODs that identified mercury as a site contaminant, and municipal landfills as the source or potential source of contamination were examined. This review of CERCLA RODs expands and updates the Agency's examination of RODs from 1990 and 1991 done for the mercury lamps proposal (59 FR 38291). The preliminary

data are from an ongoing study of landfill leachate in which the Agency is collecting leachate contaminant concentrations (including mercury) at several types of operating and closed landfills.

The Scoping Study identified 112 cases where release of contaminants from industrial non-hazardous waste management could be verified and release data were available. Most sites had verified data because state-supervised remediation had been or was being conducted at the site; data were available from public state files. Of the 112 cases identified, 19 (17%) identified mercury releases, primarily to groundwater. Either state or federal regulatory standards were exceeded in 6 of the 19 cases (32%, or 5% of the total cases; 5 cases exceeded federal or state MCLs; one exceeded a soil clean-up value). Only general data on the waste disposed in these units were available, although several locations with MCL exceedences received paper mill sludges.

The Agency also reviewed additional data in CERCLA RODS dating from 1985 through 1997 to see whether mercury releases have occurred at MSW landfills where remediation was required. Of the 1211 current sites on the NPL, 82 are identified by SIC code as MSW landfills. Approximately 150 NPL sites (total) include **A**landfill or **A**dump@in their name, and which, on examination of their RODs, were found to have accepted MSW during their operating life. Of these, mercury was detected at 39 sites (26% of MSW sites; 51 RODs-- some sites have multiple RODs). Mercury concentrations in groundwater or surface water exceeded the MCL at five sites clearly identified as MSW units, and the MCL was exceeded at two more units that were not identified as MSW landfills by SIC code. Two RODs identified residential drinking water wells as sampling locations, one with mercury far above the MCL, and one with mercury equal to the MCL at the well, at distances up to one and a half miles from the source of contamination. Five more facilities had groundwater or surface water contaminated with mercury at 10% or more of the MCL concentration. Data on waste disposed in these landfills were not available.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time-span. The RODs discussed in the mercury lamps proposal concerned only municipal solid waste disposal sites and date only from 1990 and 1991. In that review, the Agency identified mercury as a constituent of concern at 12 of 66 sites that received municipal solid waste. Of these, five sites had wells contaminated with mercury at concentrations above the MCL. While the Agency did not view the ROD data at proposal as an indication that significant amounts of mercury are being released from MSW landfills, data from the expanded and updated RODs analysis show that this preliminary conclusion was not correct, and that mercury contamination of groundwater from landfills is more widespread than previously believed. However, even the original RODs review discussed in the proposal indicated that mercury does leach from MSW landfills. However, the Agency noted that four of the five sites also received industrial waste, and focused only on data from the remaining site. The data from that site showed on-site mercury concentrations above the MCL and off-site groundwater samples below detection limits for mercury. It is apparent that the hasty inference from one site that mercury contamination will not spread off-site was unwarranted.

Finally, as part of its efforts to review the TCLP test and its application in the RCRA programs, the Agency has collected data on landfill leachate composition for MSW, industrial D, and hazardous waste landfills. Preliminary analysis of the MSW landfill data from the study identified mercury (total) in 10/170 leachate samples, with the median mercury concentration (where mercury was found) at 40% of the MCL (0.0008 mg/l), and the 90<sup>th</sup> percentile value 30 times the MCL concentration, or at 30% of the toxicity characteristic value (0.061 mg/l). The hazardous waste landfill leachate showed higher mercury concentrations, and the industrial, non-hazardous landfills showed lower mercury concentrations in the leachate.

These data clearly show that the TCLP test and the dilution/attenuation factor used for mercury in the toxicity characteristic rule are at best only slightly conservative for mercury, and do not grossly overestimate mercury leaching and groundwater fate and transport. They show very clearly that mercury can be leached from waste and released to the groundwater at levels that are significant to the environment, from several landfill types, including MSW landfills. In MSW landfill leachate, mercury at 30% of the toxicity characteristic value indicates that the TCLP test may be somewhat, but not excessively conservative. Mercury in groundwater at levels exceeding the MCL indicates clearly that mercury can not only leach from waste but can also be transported at environmentally significant concentrations in groundwater. Given these data, the Agency's preliminary conclusion that mercury is not being readily leached from MSW landfills appears to be unfounded.

These data could be used to update the analysis of mercury releases from landfills in the RTI report, and would undoubtedly show an increased rate of release compared with EPA's 1992 analysis. However, and more significantly, these data show not only mercury releases at higher concentrations in the leachate, they also show environmentally significant levels of mercury in groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate that a significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.



DCN FLEP-00228

COMMENTS STAPPA/ALAPCO

SUBJECT TOX

COMMENT Setting a Precedent. The precedent of allowing certain materials that do not pass the Toxicity Characteristic Leaching Procedure test to be treated as non-hazardous materials is very inconsistent with the intent of RCRA. The fact that the decision is based upon very little sound scientific data exacerbates the situation. It would open the door for any hazardous waste material to be excluded from regulation.

RESPONSE

The Agency thanks the commenter for submitting comments on the proposed rule. In today's final rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Today's rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to LDR standards unless they are recycled. EPA studies have determined that the majority of spent lamps fail the TCLP for mercury, and that some spent lamps fail the TCLP for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit a hazardous waste characteristic are subject to today's final rule.

DCN FLEP-00256

COMMENTS Ford Motor Company

SUBJECT TOX

COMMENT Additional TCLP Data for Various Lamp Types. The Agency has requested that commenters submit any TCLP data for the various lamp types. Attachment 2 is a summary of results of TCLP testing conducted in 1991. [See hard copy of Comment FLEP-00256 for attachments.] As noted by the Agency, electric lamp manufacturers continue to reduce the amount of mercury in lamps by more efficient manufacturing techniques, so these data may not represent 1994 manufactured product results.

RESPONSE

The Agency thanks the commenter for submitting additional TCLP data for various lamp types. Today's rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. EPA studies, as well as data provided by commenters, have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead. Spent lamps that fail the TCLP for any hazardous constituent or that

exhibit a hazardous waste characteristic are subject to today's final rule. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards) but still requires that lamps be treated to LDR standards before disposal, unless they are recycled.

DCN FLEP-00301

COMMENTS Minnesota Pollution Control Agency/MOEA

SUBJECT TOX

COMMENT 8. Precedent of CE Alternative for the Toxicity

Characteristic Leaching Procedure (TCLP). EPA data shows lamps are hazardous using the TCLP. Therefore, the CE alternative casts doubt on the TCLP method for determining whether a waste is hazardous. In this case, a whole separate rulemaking should take place, prior to allowing conditional exemptions. In such a rulemaking, states and other interested persons would have an opportunity to argue for a broadening of the parameters for determining whether a mercury waste is hazardous to account for other release pathways in the "real life" solid waste management system (i.e., transportation, incineration; composting, shredding/processing facilities). Until such time, the UW alternative, which is totally consistent with the current RCRA program should be finalized.

RESPONSE

The Agency thanks the commenter for submitting comments on the proposed rule. In today's final rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Today's rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule.

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed

groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

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groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate that a significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.

However, because these studies are not complete, the Agency has not come to any final conclusions about the need to revise the TC regulation for mercury. The current TC regulation may be intentionally conservative in some respects (see 55 FR 11800, March 29, 1990), but not in other respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, EPA 1997).

DCN FLEP-00301

COMMENTS Minnesota Pollution Control Agency/MOEA

SUBJECT TOX

COMMENT D. Mercury in Landfill Gas Emissions. EPA states that MINTEQ, a metal speciation model, will be used to evaluate the toxicity characteristic regulatory levels for mercury and other TC metals. MINTEQ is described in the proposal as a solid waste landfill leachate behavior model. There is one publication on MINTEQ available. [Note 20: "A Geochemical Assessment Model for Environmental Systems." EPA/600-3-91-021. U.S. Environmental Protection Agency. Washington, D.C.. (U.S. EPA 1991b.)] It appears that MINTEQ is solely a computer model and is not based on experimental data. On page 62 of the MINTEQ publication, there is a discussion of chemical compounds present in as emissions from solid waste landfills. Nine of the thirteen vapor emission compounds listed contain mercury. Nowhere in the

Proposal does EPA discuss the gas emission component of MINTEQ and the implications of page 62.

#### RESPONSE

The MINTEQ model is designed to evaluate only potential groundwater fate and transport of mercury released in landfill leachate. The Agency relied upon other available data to evaluate potential air emissions of mercury and emissions of mercury in landfill gas. The Agency published a Notice of Data Availability on July 11, 1997 (62 FR 37183). This notice presented data collected by the Agency and an assessment of potential mercury emissions from the management of hazardous waste lamps under several regulatory approaches. In addition to these analyses, the Agency is continuing to develop and validate the MINTEQ model and its applications for determining the groundwater fate and transport of hazardous metals.

One of the studies cited in the July 11, 1997 notice and background document included a review of available data on mercury releases from landfills. The study included a calculated mercury landfill air emissions rate of 0.8 kg/yr nationwide. Another study summarized in the July 11, 1997 background document measured mercury air emissions from broken bulbs under soil cover depths of 0.5 feet and 1.0 feet. Releases from the 0.5 foot soil cover system averaged 0.8 percent of the total mercury content over a 20-day period. The system with a one foot cover averaged releases of 0.2 percent of total mercury content over a 20-day period.

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve for well contamination at the MCL concentration (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

Today's rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. Today's final rulemaking has not changed the regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP).

DCN FLEP-L0001

COMMENTER Environmental Technology Council

SUBJECT TOX

COMMENT IV. USED FLUORESCENT LAMPS ARE A GROWING CONTRIBUTOR TO THE MERCURY PUBLIC HEALTH AND ENVIRONMENTAL PROBLEM; EPA'S ARGUMENTS FOR EXEMPTING THESE LAMPS ARE REPUTED BY THE ESTABLISHED MERCURY CHARACTERISTIC LEVEL

EPA acknowledges that "a relatively high percentage" of used fluorescent lamps exceed the 0.2 mg/l toxicity characteristic (TC) level for mercury, and thus are hazardous wastes. 59 Fed. Reg. at 38,289. In fact, as discussed below, the TCLP understates the environmental and public health risks posed by mercury wastes. In addition, fluorescent lamps are a growing part of the mercury contamination problem. Nevertheless, EPA seems to argue that municipal solid waste landfills have not released high levels of mercury to the environment, and therefore fluorescent lamps need not be managed as hazardous wastes. EPA's establishment of the 0.2 mg/l TC level for mercury, however, is based on EPA's unrefuted demonstration that mercury at this level is a threat to the environment. There is no basis for exempting this particular mercury waste (i.e., fluorescent lamps) from hazardous waste regulations that govern other mercury wastes at similar concentrations. A. Used Fluorescent Lamps Are Hazardous Waste

The National Electrical Manufacturers Association (NEMA) submitted a request to EPA some time ago to exempt used mercury-containing fluorescent lamps from hazardous waste regulations. NEMA asserted that the Toxicity Characteristic Leaching Procedure (TCLP), which is the standard procedure for determining whether a metal waste is characteristically hazardous, is not valid for fluorescent lamps. NEMA argued that TCLP tests on fluorescent lamps had shown a high degree of variability and had been inconclusive. [12] [Footnote 12: Analytical Results of Mercury in Fluorescent , Science Applications International Corporation (SAIC), EPA Contract #68-WO-0027, May 15, 1992, p. 1.] In response, EPA contracted with Science Applications International Corporation (SAIC) to assess NEMA's assertions. SAIC conducted sampling and analysis of fluorescent lamps, under EPA guidance, and submitted its report to EPA in May, 1992[13] [Footnote 13: Ibid., p. 2.] The EPA/SAIC results "demonstrate that the TCLP is adequately

precise when properly applied to fluorescent lamps and that fluorescent lamps exhibit the toxicity characteristic as measured by the TCLP." [14] [Footnote 14: Risk Assessment, p. 70 (emphasis added)] B. The TCLP Understates the Environmental and Public Health Risk of Mercury The TCLP is used to determine whether a waste is toxic based upon the potential for toxic constituents in the waste to leach out of an unlined municipal landfill into groundwater. 59 Fed. Reg. at 38,288. Disposal in a solid waste landfill is believed to be generally the most likely method of disposal of metal solid wastes if they are not managed as a hazardous waste.

#### RESPONSE

The Agency thanks the commenter for submitting comments on the proposed rule. In today's final rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Today's rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. Today's final rulemaking has not changed the regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP).

There are many reasons for variability in TCLP test results for mercury lamps. These include variation in manufacturing practices and lamp age and condition at the time of disposal. The 1992 SAIC study was the Agency's initial response to variability in TCLP results that may be attributed to TCLP test design. The report suggested a solution to the most significant factor in the TCLP design that caused variable results for lamps B the subsampling required in using a 100 gram sample of waste. The suggested protocol adjustment to account for the debris-like nature of lamps was to conduct a TCLP leach test on the whole lamp using six liters of leachate; this issue is discussed in greater detail in the Memorandum to the Record from Gregory Helms and Steven Silverman titled AResponse to Comments of Beveridge and Diamond,@ June 24, 1999, and in the RTI Report. In addition, EPA has worked with NEMA over the intervening time to create additional sample preparation refinements that can reduce variability.

The Agency notes that studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to study the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. Today's final rulemaking has not changed the regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP).



DCN FLEP-L0001

COMMENTS Environmental Technology Council

SUBJECT TOX

COMMENT RCRA directs EPA to determine whether a waste may pose a substantial hazard to human health and the environment when improperly managed. RCRA ' 1004(5). The only reasonable construction of the statutory definition is that a solid waste is a hazardous waste if it (1) poses a substantial hazard when properly managed, or (2) poses a substantial hazard when improperly managed. In other words, mercury-containing lamps meet the statutory definition of "hazardous waste" if they pose substantial risks when not managed in accordance with the conditions of the exclusion. EPA has no authority to deem legally irrelevant the risks posed by mismanagement. Indeed, the fact that mercury lamps typically fail the toxicity characteristic is conclusive evidence that these wastes pose substantial hazards when disposed of in municipal landfills, let alone when otherwise mismanaged.

#### RESPONSE

The Agency thanks the commenter for submitting comments on the proposed rule. In today's final rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Today's rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. Today's final rulemaking has not changed the regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP). Information in the proposed rule, as well as later corroborative data, show that a landfill disposal model is indeed a reasonable one to use to evaluate whether these lamps exhibit the characteristic of toxicity since these data and other information show that 1) the lamps are typically disposed in MSWLFs; 2) mercury will escape from the lamp matrix; 3) mercury is capable of migrating from MSWLFs in substantial concentrations to harm human and other receptors (as well as to contaminate groundwater); and 4) the mercury in lamps is present in mobile (divalent) form. For these reasons, the waste meets the statutory definition of hazardous waste cited by the commenter (and largely for the general reasons supplied in this comment).

The Agency does not have extensive data characterizing the behavior of mercury released from spent lamps in a landfill environment over long periods of time, although the available data suggest that mercury can be, and has been released to groundwater and air from landfills. Studies on the

evaluation of the fate and transport of TC metals (including mercury) in this context are still ongoing. As pointed out by the commenter, these analyses include additional development and validation of the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. However, because these studies are not complete, the Agency has not come to any final conclusions about the need to revise the TC regulation for mercury. The current TC regulation may be conservative in some respects (see 55 FR 11800, March 29, 1990), but not in other respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, EPA 1997).

Studies also show that there is a significant threat of mercury releases from the management of lamps is during storage and transport. Uncontrolled crushing and breaking of lamps allows mercury to be emitted into the air. The universal waste rule provides a reduced, or streamlined set of requirements that allow the Agency to set specific management standards to control potential emissions. The universal waste rule provides a format for controlling the management of spent lamps during storage and transport, while at the same time providing a more streamlined and less stringent set of standards than the Subtitle C management standards for generators and transporters of hazardous waste lamps.

DCN FLEP-L0001

COMMENTER Environmental Technology Council

SUBJECT TOX

COMMENT Fluorescent lamps apparently did not generally test as hazardous for mercury under the old EP Toxic test. Since EPA switched to the more accurate TCLP test in 1990, fluorescent lamps generally do test as hazardous for mercury.

However, it is now four years since the promulgation of the TCLP test. There has been considerable publicity and information provided in the industry regarding fluorescent lamps and their proper disposal since then; particularly in connection with the development of the proposed regulation that is the subject of these comments. In fact, EPA has devoted an entire pamphlet to, "Lighting Waste Disposal," which specifically states: "If you do not test used fluorescent and HID lamps and prove them non-hazardous, assume they are hazardous and dispose them accordingly." [27] [Footnote 27: "Lighting Waste Disposal," p.7.] This is a clear-cut guidance. The pamphlet clarifies hazardous waste testing; disposal and recycling requirements, as well as disposal and recycling costs.

RESPONSE

The Agency thanks the commenter for the observations regarding the TCLP. Today's rule adds

hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. Today's final rulemaking has not changed the regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP).

The Agency agrees that reduced mercury in lamps may make use of the older TCLP test data unreliable for hazardous waste identification. Nonetheless, making an accurate waste determination remains the obligation of the waste generator. The Agency assumes that as lower-level mercury lamps that pass the TCLP are developed by manufacturers, they will develop TCLP data on the newer lamps and make it available to their customers. While the TCLP test may not be a precise predictor of lamp mercury fate in MSWLFs, the Agency does not believe a test only for lamps is warranted.

DCN SCSP-L0009

COMMENTS National Electric Manufacturers Assn.

SUBJECT TOX

COMMENT Background Although the Toxicity Characteristic test for this waste is seriously flawed, a significant percentage of lamps containing mercury fail the test for mercury and, therefore, are regulated as hazardous waste when disposed. This fact concerns lamp manufacturers for two important reasons. First, based on analysis of actual landfill data in the report prepared for David Layland of your staff dated October 1992 and entitled, Management of Used Fluorescent Lamps: Preliminary Risk Assessment (RTI report), NEMA believes that the Toxicity Characteristic over-predicts the leaching and transport of mercury in landfill and sub-surface environments and, thus, lamps are unnecessarily regulated as a hazardous waste. Recognizing that lamps are not the only waste that may be over-regulated by the Toxicity Characteristic, EPA staff has indicated that an exemption for lamps could eventually be followed by a revision to the Toxicity Characteristic regulatory level for mercury, such that mercury-containing wastes other than lamps would also be de-regulated. NEMA has no objection to such a long-term solution. This type of major rule, however, could not be issued quickly. EPA has already promulgated carefully-defined exemptions to the hazardous waste definition

for other wastes where the environment is protected and the public interest is served. The exemptions for contaminated soils at underground storage tank sites and contaminated groundwater at hydrocarbon recovery operations are two examples. As should be the case with lamps, these actions were taken quickly for important public policy reasons.

#### RESPONSE

The Agency thanks the commenter for the observations regarding the proposed rule and the TCLP. Today's rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule. Today's final rulemaking has not changed the regulatory limit for mercury (i.e., 0.2 mg/L using the TCLP).

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

Because of significant commenter interest in the leaching and groundwater fate and transport of mercury in landfills, the Agency has reviewed two readily and publicly available data sources on the release of mercury to groundwater from landfills, and also preliminary results of an ongoing Agency study on landfill leachate. The first data source is the 1996 Hazardous Waste Characteristics Scoping Study in which the Agency identified verified releases of chemicals (including mercury) from industrial non-hazardous and construction and demolition landfills. The second data source is a set of Records of Decision (RODs) created by the CERCLA program in studying contaminated sites and developing remedies for the sites. RODs that identified mercury as a site contaminant, and municipal landfills as the source or potential source of contamination

were examined. This review of CERCLA RODs expands and updates the Agency's examination of RODs from 1990 and 1991 done for the mercury lamps proposal (59 FR 38291). The preliminary data are from an ongoing study of landfill leachate in which the Agency is collecting leachate contaminant concentrations (including mercury) at several types of operating and closed landfills.

The Scoping Study identified 112 cases where release of contaminants from industrial non-hazardous waste management could be verified and release data were available. Most sites had verified data because state-supervised remediation had been or was being conducted at the site; data were available from public state files. Of the 112 cases identified, 19 (17%) identified mercury releases, primarily to groundwater. Either state or federal regulatory standards were exceeded in 6 of the 19 cases (32%, or 5% of the total cases; 5 cases exceeded federal or state MCLs; one exceeded a soil clean-up value). Only general data on the waste disposed in these units were available, although several locations with MCL exceedences received paper mill sludges.

The Agency also reviewed additional data in CERCLA RODs dating from 1985 through 1997 to see whether mercury releases have occurred at MSW landfills where remediation was required. Of the 1211 current sites on the NPL, 82 are identified by SIC code as MSW landfills. Approximately 150 NPL sites (total) include "landfill" or "dump" in their name, and which, on examination of their RODs, were found to have accepted MSW during their operating life. Of these, mercury was detected at 39 sites (26% of MSW sites; 51 RODs-- some sites have multiple RODs). Mercury concentrations in groundwater or surface water exceeded the MCL at five sites clearly identified as MSW units, and the MCL was exceeded at two more units that were not identified as MSW landfills by SIC code. Two RODs identified residential drinking water wells as sampling locations, one with mercury far above the MCL, and one with mercury equal to the MCL at the well, at distances up to one and a half miles from the source of contamination. Five more facilities had groundwater or surface water contaminated with mercury at 10% or more of the MCL concentration. Data on waste disposed in these landfills were not available.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time-span. The RODs discussed in the mercury lamps proposal concerned only municipal solid waste disposal sites and date only from 1990 and 1991. In that review, the Agency identified mercury as a constituent of concern at 12 of 66 sites that received municipal solid waste. Of these, five sites had wells contaminated with mercury at concentrations above the MCL. While the Agency did not view the ROD data at proposal as an indication that significant amounts of mercury are being released from MSW landfills, data from the expanded and updated RODs analysis show that this preliminary conclusion was not correct, and that mercury contamination of groundwater from landfills is more widespread than previously believed. However, even the original RODs review discussed in the proposal indicated that mercury does leach from MSW landfills. However, the Agency noted that four of the five sites also received industrial waste, and focused only on data from the remaining site. The data from that site showed on-site mercury concentrations above the MCL and off-site groundwater samples below detection limits for mercury. It is apparent that the hasty inference from one site that mercury contamination

will not spread off-site was unwarranted.

Finally, as part of its efforts to review the TCLP test and its application in the RCRA programs, the Agency has collected data on landfill leachate composition for MSW, industrial D, and hazardous waste landfills. Preliminary analysis of the MSW landfill data from the study identified mercury (total) in 10/170 leachate samples, with the median mercury concentration (where mercury was found) at 40% of the MCL (0.0008 mg/l), and the 90<sup>th</sup> percentile value 30 times the MCL concentration, or at 30% of the toxicity characteristic value (0.061 mg/l). The hazardous waste landfill leachate showed higher mercury concentrations, and the industrial, non-hazardous landfills showed lower mercury concentrations in the leachate.

These data clearly show that the TCLP test and the dilution/attenuation factor used for mercury in the toxicity characteristic rule are at best only slightly conservative for mercury, and do not grossly overestimate mercury leaching and groundwater fate and transport. They show very clearly that mercury can be leached from waste and released to the groundwater at levels that are significant to the environment, from several landfill types, including MSW landfills. In MSW landfill leachate, mercury at 30% of the toxicity characteristic value indicates that the TCLP test may be somewhat, but not excessively conservative. Mercury in groundwater at levels exceeding the MCL indicates clearly that mercury can not only leach from waste but can also be transported at environmentally significant concentrations in groundwater. Given these data, the Agency's preliminary conclusion that mercury is not being readily leached from MSW landfills appears to be unfounded.

These data could be used to update the analysis of mercury releases from landfills in the RTI report, and would undoubtedly show an increased rate of release compared with EPA's 1992 analysis. However, and more significantly, these data show not only mercury releases at higher concentrations in the leachate, they also show environmentally significant levels of mercury in groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate that a

significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.

However, because these studies are not complete, the Agency has not come to any final conclusions about the need to revise the TC regulation for mercury. The current TC regulation may be intentionally conservative in some respects (see 55 FR 11800, March 29, 1990), but not in other respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, EPA 1997).

Regarding the TCLP test, the test has been upheld as a means of identifying metal-containing solid wastes as hazardous. When the Agency promulgated the TCLP method for testing whether wastes exhibit the toxicity characteristic, the applicability of the TCLP test to mineral processing wastes was challenged in Edison Electric Institute v. EPA, 2 F.3d 438, 444-45 (D.C. Cir. 1993) (AE Edison). The Court ruled in Edison that applying the TCLP test to mineral processing wastes is appropriate if the evidence available to EPA shows that disposing of such wastes in municipal solid waste landfills (MSWLF) is a "plausible" mismanagement scenario (not necessarily a typical or common scenario), 2 F.3d at 446. Moreover, the Court found that it is sufficient if there is Aevidence or explanation on the record to justify a conclusion that mineral wastes ever come into contact with any form of acidic leaching medium. @ Id. at 447. A significant amount of data has been submitted to the Agency indicating that a widespread current practice is to dispose of spent mercury-containing lamps in municipal solid waste landfills, so this is clearly a reasonable disposal scenario to model. Disposal of an industrial waste in such landfills, and the risk to groundwater resulting from that disposal, is the scenario that EPA sought to incorporate into the TCLP test and TC regulation. As at proposal, EPA continues to believe that the mobility and fate and transport features of the TC (i.e., the leaching procedure and the fate and transport assumptions built into the regulatory limit) are reasonable for mercury-containing lamps, given that 1) mercury will be mobilized from the lamps when the lamps are crushed after disposal in landfill cells; 2) mercury is in a leachate and water-soluble form in lamps; and 3) monitoring data from MSWLFs confirm mercury can and has escaped from landfill units, causing extensive environmental contamination.

Application of the TCLP to evaluate the hazardous waste status of lamps is therefore supported by evidence of current disposal practices. Therefore, it is the Agency's conclusion that, in the case of hazardous waste lamps, the conditions set forth in Edison are met, and using the TCLP to determine whether such lamps are hazardous waste is supported both by legal precedent and fact.

DCN FLEP-L0011

COMMENTS No Affiliation (name illegible)

SUBJECT TOX

COMMENT When the threshold levels were set for TCLP constituents, it was determined that any wastes which leach mercury at or above 0.2 ppm were hazardous and needed to be managed in a RCRA facility.

In a recent report by SAIC, a project commissioned by EPA, 14 out of 14 fluorescent light bulbs sampled failed TCLP for mercury. That's pretty overwhelming evidence that these light bulbs are hazardous waste. To even consider allowing this waste to be disposed in a municipal landfill creates a myriad of problems for the agency not the least of which is the credibility of EPA to reach correct environmental conclusions when presented with excellent data from studies commissioned by EPA. Listed below are a few of the problems this proposal creates: 1. EPA has a standard for determining when a mercury bearing waste is hazardous, i.e. 0.2 ppm of leachable mercury. How can you now declare fluorescent light tubes to be non-hazardous, given that they exceed the TCLP threshold. Either the fluorescent light tubes are hazardous or the TCLP threshold is wrong. You can't have it both ways.

#### RESPONSE

The Agency thanks the commenter for the observations regarding the proposed rule and the TCLP. The Agency notes that today's rule does not change the role of The TCLP in determining whether a solid waste is a characteristic hazardous waste and does not change the regulatory threshold concentrations for any of the hazardous waste characteristics. In today's rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule.

Regarding the disposal of hazardous waste lamps, today's rule specifies that universal waste destination facilities (i.e., facilities that treat, dispose, or recycle universal waste) are subject to all applicable Subtitle C requirements for hazardous waste treatment, storage, and disposal facilities and must receive a RCRA permit for such activities. However, hazardous waste recycling facilities that do not store hazardous wastes prior to recycling may be exempt from permitting under federal regulations (40 CFR 261.6(c)(2)).

DCN FLEP-L0014

COMMENTS General Electric

SUBJECT TOX

COMMENT We believe these recommendations resolve a host of issues and problems that have arisen since the adoption of the TCLP and its application to mercury-containing lamps. Most importantly, we



believe this approach will result in significant reductions in mercury use and in environmental releases of mercury. As we have pointed out before, the BMPs we propose are designed to eliminate a primary source of mercury releases--air releases from incineration as well as minimize releases from accidental breakage. In addition, by setting a relatively short deadline for the exclusion to expire, lamp, users will demand low mercury-containing lamps that will pass the TCLP correlation test. If properly developed, the correlation test will be based on mercury levels rather than non-mercury factors that affect TCLP results. GE Lighting and other lamp manufacturers, therefore, will have a strong market incentive to produce lamps with the lowest possible levels of mercury. Benefits to Generators This approach resolves the increasingly problematic issues and costs facing generators. Although many of today's spent lamps fail the TCLP, some do not. The percentage that pass is rising and will continue to rise because newer lamps contain less mercury. Generators are facing real uncertainty over whether their lamps are hazardous or not and whether they should invest in costly testing. Developing a test based on a correlation of mercury levels in new lamps and for TCLP test resolves these generator issues. It eliminates the need for generators to pay for testing and provides them surety both at the time of spent lamp generation and lamp purchase that their lamps either are or are not hazardous wastes. GE Lighting would be willing to provide the necessary testing data to develop such a test.

#### RESPONSE

The Agency thanks the commenter for submitting information addressing good management practices of mercury-containing lamps. However, the Agency is not adopting the conditional exclusion approach supported by the commenter and is not including a sunset provision with today's final rule. The Agency agrees that reduced mercury in lamps may make use of the older TCLP test data unreliable for hazardous waste identification. Nonetheless, making an accurate waste determination remains the obligation of the waste generator. The Agency assumes that as lower-level mercury lamps that pass the TCLP are developed by manufacturers, the manufacturers will also develop TCLP data on the newer lamps and make these data available to their customers.

While the TCLP test may not be a precise predictor of lamp mercury fate in MSWLFs, the Agency does not believe a test only for lamps is warranted.

In today's rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273.

The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead.

Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule.

The Agency also notes that estimated mercury emissions would be reduced most under any of the universal waste implementation approaches evaluated, when compared with either baseline emissions or estimated emissions under the conditional exclusion (see Table 3-R of EPA's 1997 Air Emissions Study).

The Agency supports manufacturer efforts to produce lamps with lower mercury content, since mercury can be persistent in the environment. EPA also notes that some lamp manufacturers have successfully reduced the total mercury in their lamps. Reductions in total mercury will reduce risks by both the groundwater and air release pathways. To the degree that modifications to lamp chemistry truly immobilize the mercury that is present, the Agency supports these efforts also. The Agency is concerned about products that are designed to pass the TCLP test when they become a waste, but in which the apparent reduction in mercury mobility lasts only as long as TCLP test. While the Agency cannot address this issue in this rulemaking, a review of the TCLP test has been initiated by the Agency (see 63 FR 28579, May 26, 1998). Evaluation of the possibility of Atricking@the TCLP through short-term changes to waste chemistry is one of the topics likely to be addressed in that review.

The Agency appreciates the commenter's interest in alternative testing mechanisms for hazardous waste lamps. The Agency is continuing to develop and validate models for determining the fate and transport of hazardous constituents.

DCN FLEP-L0013

COMMENTS Osram Sylvania

SUBJECT TOX

COMMENT It has been demonstrated that, by a combination of source reduction, lamp coating and chemistry, soluble mercury in a spent lamp can be reduced in the final stages of the TCLP test. OSRAM SYLVANIA (OSI) holds two patents on such a process. Recent publicity for source-reduced fluorescent lamps claims to pass TCLP refer to "chemical balance", and a mercury dose of approx. 9 mg. The mercury dose required for a typical 4-ft. fluorescent lamp is approximately 2 mg to pass TCLP under all circumstances without either the coating or chemistry being used to some extent.

RESPONSE

The Agency thanks the commenter for the data on mercury content in lamps that pass The TCLP.

The Agency also commends the commenter's efforts in reducing the amount of mercury in fluorescent lamps. Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule.

The Agency supports manufacturer efforts to produce lamps with lower mercury content, since mercury can be persistent in the environment. EPA also notes that some lamp manufacturers have successfully reduced the total mercury in their lamps. Reductions in total mercury will reduce risks by both the groundwater and air release pathways. To the degree that modifications to lamp chemistry truly immobilize the mercury that is present, the Agency supports these efforts also. The Agency is concerned about products that are designed to pass the TCLP test when they become a waste, but in which the apparent reduction in mercury mobility lasts only as long as TCLP test. While the Agency cannot address this issue in this rulemaking, a review of the TCLP test has been initiated by the Agency (see 63 FR 28579, May 26, 1998). Evaluation of the possibility of Attricking@the TCLP through short-term changes to waste chemistry is one of the topics likely to be addressed in that review.

DCN SCSP-00077

COMMENTS U.S. Department of Energy

SUBJECT TOX

COMMENT (5)The risk posed by management of the hazardous waste in the municipal waste stream (i.e, in municipal combustors or landfills) is relatively high; Mercury is present in small amounts in all fluorescent lamps. One particular lighting manufacturer's data indicated that the amount of mercury contained in a fluorescent lamp is roughly proportional to its length, being about 10- to 15-milligrams per foot. As an example, a standard four-foot lamp contains approximately 50-milligrams or less of mercury, while an eight-foot lamp may contain 75- to 100-milligrams. Data from the same manufacturer indicated that mercury and metal halide high- pressure discharge lamps contain between 13- and 250-milligrams mercury per lamp, the amount increasing along with the wattage. Logically, it is expected that placement of these lamps in municipal landfills, followed by compaction, would cause the majority of lamps to break and emit mercury. As noted above, incandescent lamps typically are constructed of lead soldered bases (95 percent

lead in solder) and flare glass (20 percent lead glass). High-intensity discharge lamps also contain lead solder on the base of the lamps. Disposal of large quantities of fluorescent, incandescent, and high-intensity discharge lamps in an acidic environment such as a municipal landfill would, over time, cause leaching of mercury and lead and would be expected to pose a cumulative impact on the environment. Disposal of these lamps in municipal landfills does not minimize long-term threats to human health or the environment posed by the toxic constituents, and it would be expected that migration of these constituents would occur after disposal. Therefore, fluorescent, incandescent, i.e., high-intensity discharge lamps generally meet the proposed criteria of 40 CFR 273.2(a)(5) (i.e., management of the candidate waste in a municipal landfill poses risk).

#### RESPONSE

The Agency thanks the commenter for the data provided on mercury toxicity. In today's rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Today's rule specifies that universal waste destination facilities (i.e., facilities that treat, dispose, or recycle universal waste) are subject to all applicable Subtitle C requirements for hazardous waste treatment, storage, and disposal facilities and must receive a RCRA permit for such activities. However, hazardous waste recycling facilities that do not store hazardous wastes prior to recycling may be exempt from permitting under federal regulations (40 CFR 261.6(c)(2)).

The Agency notes that data collected for the 1996 Characteristic Scoping Study support the commenter's concerns about both mercury and lead placed in landfills. A set of 112 case studies identified there found mercury in groundwater at 19 of the 112 sites, in five cases at concentrations above a state or federal regulatory level. For lead, 22 of 37 sites with some lead exceeded state or federal regulatory levels.

DCN FLEP-00090

COMMENTS The Boeing Company

SUBJECT TOX

COMMENT 1. Based on the latest findings from EPA's MINTEQ model, the mobility of mercury may actually be less than the current rules indicate which means contamination of mercury in landfills may not be as major an issue as indicated earlier.

#### RESPONSE

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model

and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

Because of significant commenter interest in the leaching and groundwater fate and transport of mercury in landfills, the Agency has reviewed two readily and publicly available data sources on the release of mercury to groundwater from landfills, and also preliminary results of an ongoing Agency study on landfill leachate. The first data source is the 1996 Hazardous Waste Characteristics Scoping Study in which the Agency identified verified releases of chemicals (including mercury) from industrial non-hazardous and construction and demolition landfills. The second data source is a set of Records of Decision (RODs) created by the CERCLA program in studying contaminated sites and developing remedies for the sites. RODs that identified mercury as a site contaminant, and municipal landfills as the source or potential source of contamination were examined. This review of CERCLA RODs expands and updates the Agency's examination of RODs from 1990 and 1991 done for the mercury lamps proposal (59 FR 38291). The preliminary data are from an ongoing study of landfill leachate in which the Agency is collecting leachate contaminant concentrations (including mercury) at several types of operating and closed landfills.

The Scoping Study identified 112 cases where release of contaminants from industrial non-hazardous waste management could be verified and release data were available. Most sites had verified data because state-supervised remediation had been or was being conducted at the site; data were available from public state files. Of the 112 cases identified, 19 (17%) identified mercury releases, primarily to groundwater. Either state or federal regulatory standards were exceeded in 6 of the 19 cases (32%, or 5% of the total cases; 5 cases exceeded federal or state MCLs; one exceeded a soil clean-up value). Only general data on the waste disposed in these units were available, although several locations with MCL exceedences received paper mill sludges.

The Agency also reviewed additional data in CERCLA RODs dating from 1985 through 1997 to see whether mercury releases have occurred at MSW landfills where remediation was required. Of the 1211 current sites on the NPL, 82 are identified by SIC code as MSW landfills. Approximately 150 NPL sites (total) include landfill or dump in their name, and which, on examination of their RODs, were found to have accepted MSW during their operating life. Of these, mercury was detected at 39 sites (26% of MSW sites; 51 RODs-- some sites have multiple RODs). Mercury concentrations in groundwater or surface water exceeded the MCL at five sites clearly identified as MSW units, and the MCL was exceeded at two more units that were not identified as MSW landfills by SIC code. Two RODs identified residential drinking water wells as sampling locations,

one with mercury far above the MCL, and one with mercury equal to the MCL at the well, at distances up to one and a half miles from the source of contamination. Five more facilities had groundwater or surface water contaminated with mercury at 10% or more of the MCL concentration. Data on waste disposed in these landfills were not available.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time-span. The RODs discussed in the mercury lamps proposal concerned only municipal solid waste disposal sites and date only from 1990 and 1991. In that review, the Agency identified mercury as a constituent of concern at 12 of 66 sites that received municipal solid waste. Of these, five sites had wells contaminated with mercury at concentrations above the MCL. While the Agency did not view the ROD data at proposal as an indication that significant amounts of mercury are being released from MSW landfills, data from the expanded and updated RODs analysis show that this preliminary conclusion was not correct, and that mercury contamination of groundwater from landfills is more widespread than previously believed. However, even the original RODs review discussed in the proposal indicated that mercury does leach from MSW landfills. However, the Agency noted that four of the five sites also received industrial waste, and focused only on data from the remaining site. The data from that site showed on-site mercury concentrations above the MCL and off-site groundwater samples below detection limits for mercury. It is apparent that the hasty inference from one site that mercury contamination will not spread off-site was unwarranted.

Finally, as part of its efforts to review the TCLP test and its application in the RCRA programs, the Agency has collected data on landfill leachate composition for MSW, industrial D, and hazardous waste landfills. Preliminary analysis of the MSW landfill data from the study identified mercury (total) in 10/170 leachate samples, with the median mercury concentration (where mercury was found) at 40% of the MCL (0.0008 mg/l), and the 90<sup>th</sup> percentile value 30 times the MCL concentration, or at 30% of the toxicity characteristic value (0.061 mg/l). The hazardous waste landfill leachate showed higher mercury concentrations, and the industrial, non-hazardous landfills showed lower mercury concentrations in the leachate.

These data clearly show that the TCLP test and the dilution/attenuation factor used for mercury in the toxicity characteristic rule are at best only slightly conservative for mercury, and do not grossly overestimate mercury leaching and groundwater fate and transport. They show very clearly that mercury can be leached from waste and released to the groundwater at levels that are significant to the environment, from several landfill types, including MSW landfills. In MSW landfill leachate, mercury at 30% of the toxicity characteristic value indicates that the TCLP test may be somewhat, but not excessively conservative. Mercury in groundwater at levels exceeding the MCL indicates clearly that mercury can not only leach from waste but can also be transported at environmentally significant concentrations in groundwater. Given these data, the Agency's preliminary conclusion that mercury is not being readily leached from MSW landfills appears to be unfounded.

These data could be used to update the analysis of mercury releases from landfills in the RTI

report, and would undoubtedly show an increased rate of release compared with EPA's 1992 analysis. However, and more significantly, these data show not only mercury releases at higher concentrations in the leachate, they also show environmentally significant levels of mercury in groundwater at both monitoring and drinking water wells at some distance from MSW landfills. These data provide a far more accurate view of the environmental risks posed by landfill disposal of mercury waste, and in particular, risks posed by disposal in MSWLFs, than do estimates of the fraction of mercury released from landfills via leaching (as contained in the RTI report). Estimation of the mercury fraction released was an indirect, surrogate indicator of possible mercury risk used in the absence of actual well contamination data. Actual measurements of mercury well contamination from landfills are a direct indicator of mercury groundwater risks. Mercury well contamination at concentrations equal to and greater than the MCL (which can, and has occurred from mercury waste disposal in municipal solid waste landfills) show clear significant risk to the environment and water consumers.

It should be noted, in this regard, that mercury in lamps accounts for approximately 4% of the total mercury in municipal solid waste landfills (the second largest source), contributing approximately 24 Mg/year of mercury (see the RTI Study Table 4-1, 1989 data). If in fact these measured concentrations are a result of the leaching of only a small fraction of the total mercury in MSW landfills (as indicated by the Agency's earlier analysis), the data as a whole may indicate that a significant reservoir of mercury remains in the landfills to contaminate groundwater (including groundwater drinking wells) in future years.

However, because these studies are not complete, the Agency has not come to any final conclusions about the need to revise the TC regulation for mercury. The current TC regulation may be intentionally conservative in some respects (see 55 FR 11800, March 29, 1990), but not in other respects. For example, the TC regulation does not consider the bioaccumulation potential of mercury nor its propensity for long-distance air transport and deposition in areas remote from mercury sources (see the Mercury Study Report to Congress, EPA 1997).

Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead. Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule.

DCN FLEP-00145  
COMMENTS ASTSWMO  
SUBJECT TOX  
COMMENT Unfortunately, landfill gas emissions have not been

comprehensively studied to date. However, the presence of mercury in landfill gases and gas condensates has been documented since at least 1981. Analytical methods for measuring landfill gas condensates that have been used in the past have precluded accurate measurement of mercury concentrations since they depended on boiling the test sample prior to measuring the analyses. This boiling of the test samples has allowed mercury to volatilize from the sample matrix prior to analysis. Newer analytical methods for landfill gas condensate contaminants and heightened awareness of the issues should yield better information in the future.

#### RESPONSE

EPA is continuing to evaluate landfill gas emissions to determine whether they contain significant concentrations of mercury. The Agency published a Notice of Data Availability on July 11, 1997 (62 FR 37183). This notice presented data collected by the Agency and an assessment of potential mercury emissions from the management of hazardous waste lamps under several regulatory approaches. One of the studies cited in the July 11, 1997 notice and background document included a review of available data on mercury releases from landfills. The study included a calculated mercury landfill emissions rate of 0.8 kg/yr nationwide. Another study summarized in the July 11, 1997 background document measured mercury emissions from broken bulbs under soil cover depths of 0.5 feet and 1.0 feet. Releases from the 0.5 feet soil cover system averaged 0.8 percent of the total mercury content over a 20-day period. The system with a one foot cover averaged releases of 0.2 percent of total mercury content over a 20-day period.

DCN FLEP-00176

COMMENTS Coalition of Lamp Recyclers

SUBJECT TOX

COMMENT Excluding one particular mercury hazardous waste from the hazardous waste regulations is destructive to proper management and recycling. Excluding mercury-containing lamps that have the potential to emit upwards of 34 tons annually of mercury emissions, and contain enough mercury to routinely fail TCLP, establishes a bad precedence, goes against the Pollution Prevention Act of 1990, and contributes to the atmospheric loading of mercury. Such an exclusion would seriously undercut recycling, since lamps could be disposed in ordinary municipal solid waste landfills. It would be far better to encourage a new recycling industry than discourage its development and growth.

#### RESPONSE

In today's rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The Agency has determined that hazardous waste lamps



meet the criteria established for designating a material as universal waste under 40 CFR Part 273. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., universal waste rule standards are less stringent than full Subtitle C management standards). EPA studies have shown that the majority of spent lamps fail the TCLP for mercury and that some fail for lead.

Spent lamps that fail the TCLP for any hazardous constituent or that exhibit any hazardous waste characteristic are subject to today's final rule.

The universal waste rule will not affect participation in energy-efficient lighting programs. Many commenters indicated that savings from reduced energy usage more than cover the cost of managing lamps as hazardous waste.

DCN FLEP-00262

COMMENTS OG&E Electric Services

SUBJECT TOX

COMMENT Developmental work by the Agency in evaluating the fate and transport of the toxicity characteristic (TC) metals has indicated that mercury is not as mobile in the subsurface environment as originally thought and that the current TC regulatory level for mercury may be overly conservative and may be raised. The Agency has stated that mercury leaching out of landfills would not necessarily travel far enough through groundwater to contaminate drinking water wells, depending on the distance to the well (See 59 FR 38289, July 27, 1994).

RESPONSE

The Agency notes that while significant progress has been made, studies on the evaluation of the fate and transport of TC metals (including mercury) are still ongoing. As part of these analyses, the Agency will continue to develop and validate the MINTEQ model and its application for determining the fate and transport of mercury and other hazardous metals. The December 21, 1995 proposed HWIR regulation evaluated mercury groundwater risks using the MINTEQ model and the updated groundwater fate and transport model, CMTP (Composite Model with Transformation Products). As described in the preamble to that proposal (60 FR 66372), MINTEQ accounts for pH, organic matter, and iron hydroxide content of groundwater. The proposed groundwater leaching exit level for non-wastewaters, based on the MCL of 0.002 mg/L and a slightly more protective point on the probability distribution curve (90<sup>th</sup> percentile compared with 85<sup>th</sup> percentile for the TC rule), was 0.023 mg/L, implying a dilution/attenuation of approximately 10 (60 FR 66435, 66448). Based on the HWIR proposal analysis of groundwater risks, it is far from clear that reevaluation of the mercury TC regulation would result in a significant change in the value.

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