DCN SCSP-00022
COMMENTER MRT System
SUBJECT FATE
COMMENT Fluorescent light bulbs. My comments will be focused on the problem with fluorescent tubes and HID lamps. First of all, it scares me that EPA is not including those products in the universal waste act, as they will contribute to one of the largest source of mercury pollution from spent products in the future if they are not collected and special disposed of, or recycled. As you surely are well familiar with, there is no substitute for mercury in lamps. The total quantity of mercury in sold lamps will also increase in the future, as for instance, CFLs replaces incandescent lamps as an energy efficient alternative. This is of course good for the environment as less energy consumption, mean less mercury pollution from e.g. coal fired power plants.
RESPONSE

Today=s 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.

The final definition of Alamp@ 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 A*Lamp*, also referred to as Auniversal 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.@

DCN FLEP-00024
COMMENTER EG&G Rocky Flats, Inc.
SUBJECT FATE
COMMENT While we believe regulation of fluorescent light bulbs is unnecessary, between the options offered in the NPR, we favor the Conditional Exclusion option over the Special Collection System option for several reasons. First, based on the EPA's own data, as presented in the Proposed Rule, fluorescent lamps contribute only 3.8 percent of the mercury found in Municipal Solid Waste (MSW) landfills. The largest share of mercury in

> landfills, 88 percent comes from household batteries, not fluorescent light bulbs. The Proposed Rule states that "less than 0.01 percent of the mercury in MSW landfill leaches from the landfill" (Baccini, et al., 1987). Second, the data generated for the EPA and presented in the Research Triangle Park Report states that, "The impacts of mercury in MSW landfill leachates on ground water qualify is 'negligible'." The report further states that, "no significant human exposure to mercury is likely to result from leachate contamination of ground water" because "most mercury released from the MSW landfills is retained within the waste and that the amount of mercury released from the MSW waste stream via leachate is insignificant." The report points out that the low levels of mercury observed in landfills may result from solubility constraints in a landfill environment and that large increases in the level of mercury in the waste entering the landfill will not cause comparable increases in the leachate concentration. The report concluded that MSW has a significant capacity for retaining mercury in the landfill and suggests that although adding wastes with high mercury concentrations will increase mercury levels in landfill leachates, MSW has significant capacity to fix mercury in a landfill environment.

RESPONSE

Today's final rule adds hazardous waste lamps to the universal waste regulations 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 has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste.

The Agency believes that management controls under RCRA for hazardous waste lamps are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport, to ensure safe handling of such lamps, and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Mercury is high on the Agency-s priority list of toxic pollutants, along with other heavy metals such as cadmium and lead. These metals also have been identified as constituents of some waste lamps. The primary health effects from mercury are on the neurological development of children exposed through fish consumption and on fetuses exposed through their mother-s consumption of fish.

> Although the data are limited, empirical data cited at proposal, augmented by data gathered from publicly available sources after the proposal, indicate that mercury is

capable of release from MSWLs and of migrating to contaminate groundwater in significant concentrations (in fact, on the order of, or in some cases, higher than those predicted by the TC). The principal source of these data are CERCLA RODs involving mercury releases from MSWLs. These data show that mercury can be found in municipal landfill leachate, and EPA remains concerned that landfill releases may pose threats over the long term. The Agency has concluded that some management controls are essential for these wastes.

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 (more relevant here) 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 by EPA both at proposal (59 FR at 38291) and for the final rule. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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 period. 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 RODs 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. 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^{th} 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 in MSWs (as well as other landfill types) and released to the groundwater at levels that can pose significant threats to humans and other environmental receptors. 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.

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 the 1992 analysis. Even that analysis, however, showed that mercury was capable of leaching from MSWs at concentrations exceeding federal drinking water standards, however (see 59 FR at 38291 and 38292 discussing ROD data available at that time. In retrospect, after considering a more robust database drawn largely from the same sources, EPA=s Apreliminary@ conclusions, id., were insufficiently conservative. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste, since that fraction ignores the more critical issue of potential concentrations of mercury released from MSWs into the ambient environment and potentially reaching environmental receptors. 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 show clear significant risk to the environment and to 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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

As required by the Clean Air Act Amendments of 1990, the Agency issued the *Mercury Study Report to Congress*. The study estimates the quantity of mercury emissions to the air from a number of human activities, estimates the health and environmental impacts associated with these mercury emissions, and describes the technologies available to control mercury emissions from these sources. The report concludes that there is cause to seek further reductions in mercury releases and exposures to mercury.

DCN FLEP-00025
COMMENTER Environmental Energy Group/NAEP
SUBJECT FATE
COMMENT Estimates of mercury from spent mercury bearing lamps. We question the use of 3.8% of total mercury as a 1994 level of electric lamp source contributions in the solid waste stream. We

suggest it is most likely to be considerably higher at the present time. All other sources being equal in the % of discards projected in the 1992 study (attachment 2) [See hard copy of Comment FLEP-00025 for attachment.] would reflect a 1994 straight line contribution rate of 13.7% for mercury discard contained in waste lamps. The 1989 estimated and baseline volume contained in the attachment is assumed to reflect source reduction initiatives to the 41.6 mg/lamp level noted in the preamble. Waste lamps generated during periods of time prior to lamps containing lower levels of mercury actually becoming wastes (burned out or replaced under energy efficiency projects) would reflect mercury levels at this 41.6 mg/lamp volume. It is further assumed that lower mercury lamps (those which may reach the 27.0 mg/lamp level as projected by industry) would not enter the waste stream in significant numbers until the late 1990's or later. From this earlier EPA study on mercury discards in solid waste, mercury contributions to solid waste from electric lamps was expected to represent 23.7% of the total solid waste discard volume of mercury by the year 2000. Due to the advances in reducing mercury content of certain fluorescent lamps we are unable to determine whether this 1992 study reflected these potential decreases or exactly when low mercury lamps would constitute the bulk of electric lamps actually being generated and disposed of as waste. It appears likely that lamp sources of mercury may increase overall regardless of industry efforts and that waste lamps will remain the second largest product contributor for mercury in the solid waste stream. The 3.8% level of total mercury discard contribution from waste lamps appears to be significantly understated.

RESPONSE

The 3.8% contribution of lamps to mercury in the municipal waste stream was estimated in the 1993 study performed by the Research Triangle Institute. EPA agrees with the commenter that this contribution may increase as more relamping projects occur and as the mercury content of batteries continues to decrease. The Agency is also aware that some lamp manufacturers have dramatically reduced the total amount of mercury in lamps (i.e., total per foot of lamp). Greater use of these low-mercury lamps will reduce mercury loading to the environment. The universal waste rule will reduce the cost of managing spent lamps, which should result in a greater number of lamps being collected and recycled and fewer hazardous waste lamps should be mismanaged in the municipal solid waste stream. In addition, 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, as discussed in other responses, there is ample evidence that

MSWs will not, in and of themselves, prevent mercury from being released to the ambient environment, where the mercury can (and has) contaminated groundwater, including drinking water sources. Studies also show that there is a significant threat of mercury releases to the air 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 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. While the Agency understands there has been widespread confusion about the status of lamps and proper waste management, with promulgation of this final rule the Agency expects to resolve this confusion and clearly identify the regulatory status of waste lamps and required management.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release, although that Report itself documented environmental releases from MSWs at significant levels (i.e., greater than federal drinking water standards). However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

DCN FLEP-00026
COMMENTER Thomas Industries, Inc.
SUBJECT FATE
COMMENT EPA studies have shown that mercury does not leach in significant amounts from municipal landfills, making Subtitle C landfilling unnecessary. In addition, in the area of air emissions, Subtitle C does not offer significant protection over that offered by Subtitle D, making the expense of disposal vastly disproportional to the environmental benefit achieved. In fact, U.S. lamps contain less than .2% of total mercury in the environment and account for only 3.8% of total mercury in municipal solid waste. The quantity of mercury potentially released from landfilling of lamps (.04 to .31 tons) is dwarfed by the emissions of mercury from combustion sources, estimated

to be 286 tons per year. Clearly EPA resources are better spent addressing mercury emissions from combustion than in unnecessarily regulating a minor mercury source such as fluorescent lamps.

RESPONSE

Today's final rule adds hazardous waste lamps to the universal waste regulations 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 has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. The commenter=s statement that subtitle C controls will not provide appreciable protections beyond those afforded by subtitle D MSWs is not reasonable, given evidence that mercury can be and has been released in a large number of MSWs, and has contaminated groundwater in significant concentrations after release. These types of damage incidents should not occur under subtitle C management, since disposal will occur only after pretreatment into secure landfills engineered to prevent the types of documented releases which have occurred from MSWs (and other non-subtitle C landfills).

The Agency believes that management controls under RCRA for hazardous waste lamps are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport, to ensure safe handling of such lamps, and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Mercury is high on the Agency=s priority list of toxic pollutants, along with other heavy metals such as cadmium and lead. These metals have also been identified as constituents of some waste lamps. The primary health effects from mercury are on the neurological development of children exposed through fish consumption and on fetuses exposed through their mother=s consumption of fish. Data available to the Agency show that mercury can be found in municipal landfill leachate, and EPA remains concerned that landfill releases may pose threats over the long term. The Agency has concluded that some management controls are essential for these wastes.

The Agency has reviewed several additional sources of data on release of mercury to groundwater, and supplemented the CERCLA RODs discussed at proposal with further examination of CERCLA damage sites. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

As required by the Clean Air Act Amendments of 1990, the Agency issued in 1997 the *Mercury Study Report to Congress*. The study estimates the quantity of mercury emissions to the air from a number of human activities, estimates the health and environmental impacts associated with these mercury emissions, and describes the technologies available to control mercury emissions from these sources. The report concludes that there is cause to seek further reductions in mercury releases and exposures to mercury.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00028
COMMENTER Institute of Real Estate Mgmt.
SUBJECT FATE
COMMENT A. Groundwater Impacts. The EPA's conclusion that "mercury in municipal solid wastes is not being readily released by leaching processes that typically occur in the MSW landfill environment" is a significant comment because that statement means there is a minimal threat involved in mercury not releasing into the environment. Only 3.8 percent of mercury in municipal landfills comes from lamps. Less than 0.01 percent of the mercury in landfills leaches out. That means that only 0.00038 percent of the mercury that leaches out of landfills is from lamps.
RESPONSE

The Agency believes that management controls under RCRA for hazardous waste lamps are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport, to ensure safe handling of such

lamps, and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Mercury is high on the Agency=s priority list of toxic pollutants, along with other heavy metals such as cadmium and lead. These metals have been identified as constituents of some waste lamps. The primary health effects from mercury are on the neurological development of children exposed through fish consumption and on fetuses exposed through their mother=s consumption of fish.

The statement that only .01 % of mercury will leach from an MSW appears overly speculative, and in any case, is somewhat beside the point. The key question is whehter mercury in lamps is capable of release and migration in concentrations sufficient to pose a potential threat to human health or to the environment. As explained in other responses, the answer to that question appears to be yes, given the chemically and physically available form of mercury in lamps, plus documented releases of significant concentrations of mercury from MSWs which are CERCLA sites. Data available to the Agency 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. The Agency has concluded that some management controls are essential for these wastes.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment

posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

DCN FLEP-00034
COMMENTER Leaseway Transportation Corp.
SUBJECT FATE
COMMENT Leaseway is concerned about environmental quality and supports regulatory initiatives which balance economic and environmental benefits. Leaseway wishes to offer the Agency some general comments upon the above referenced proposed rules. 1.Our primary concern stems from the lack of scientific data demonstrating that there are excessive mercury emissions and discharges related to mercury containing lights. The data presented

indicates that in over 90% of the leachate samples from municipal solid waste landfills, mercury was not present in concentrations exceeding drinking water quality standards. The preamble also questions the impact in the air quality, but offers no supporting scientific evidence for this concern.

RESPONSE

The Agency believes that management controls under RCRA for hazardous waste lamps are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport, to ensure safe handling of such lamps, and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Mercury is high on the Agency=s priority list of toxic pollutants, along with other heavy metals such as cadmium and lead. These metals have been identified as constituents of some waste lamps. The primary health effects from mercury are on the neurological development of children exposed through fish consumption and on fetuses exposed through their mother=s consumption of fish.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

As required by the Clean Air Act Amendments of 1990, the Agency issued in 1997 the *Mercury Study Report to Congress*. The study estimates the quantity of mercury emissions to the air from a number of human activities, estimates the health and environmental impacts associated with these mercury emissions, and describes the technologies available to control mercury emissions from these sources. The report concludes that there is cause to seek further reductions in mercury releases and exposures to mercury.

DCN FLEP-00051
COMMENTER Scientific Consulting Laboratories, Inc.
SUBJECT FATE
COMMENT When large numbers of lamps are thrown into dumpsters or

unsealed containers, individuals, including children, are exposed to an unnecessary risk of mercury vapor exposure. When intact lamps are dumped enmass at a landfill, harmful concentrations of mercury vapors are likely to be released exposing landfill workers, refuse drivers, and the general public that bring pickup truck loads of waste. The problem becomes more serious with the almost certain mercury contamination of landfill maintenance equipment during the burial process. It appears that once the mercury seeps into the tech and is buried at the end of the day, the likelihood of future soil or ground water pollution beneath the landfill is minimal. In addition, air emissions of mercury from the landfill after burying the mercury-contaminated waste are low. However, data regarding mercury emissions during and shortly after disposal at the landfill was not available for review. We believe it is very likely that harmful concentrations of mercury vapors will be released during the disposal process when large numbers of lamps are dumped and that continued unacceptable mercury emissions will occur while the waste is near the surface.

RESPONSE

In agreement with the commenter, the Agency believes that management controls under RCRA for hazardous waste lamps are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport, to ensure safe handling of such lamps, and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Therefore, today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273.

Mercury is high on the Agency=s priority list of toxic pollutants, along with other heavy metals such as cadmium and lead. These metals have been identified as constituents of some waste lamps. The primary health effects from mercury are on the neurological development of children exposed through fish consumption and on fetuses exposed through their mother=s consumption of fish.

The Agency does not have data characterizing the behavior of mercury in different types of landfills over long time periods, although available data from shorter-term studies suggest that mercury can be released to air and groundwater. Data from CERCLA RODs (both data cited at proposal plus supplementary data from additional RODs) show that mercury can be found in municipal landfill leachate in concentrations posing clear potential for substantial harm to human health and to the environment, and EPA remains concerned that landfill releases may pose threats over the long term. The Agency has concluded that some management controls are essential for

these wastes.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers. 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 wells in future years.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

As required by the Clean Air Act Amendments of 1990, the Agency issued in 1997 the *Mercury Study Report to Congress*. The study estimates the quantity of mercury emissions to the air from a number of human activities, estimates the health and environmental impacts associated with these mercury emissions, and describes the technologies available to control mercury emissions from these sources. The report concludes that there is cause to seek further reductions in mercury releases and exposures to mercury.

DCN FLEP-00053
COMMENTER Occidental Chemical Corporation
SUBJECT FATE
COMMENT Throughout its proposal, EPA provides information on groundwater and air studies which demonstrated mercury was not being readily released when placed into municipal solid waste landfills. Unfortunately, OxyChem has no data to support the agency's findings with respect to the background information in the proposed rule. However, OxyChem does support the agency's position on the ability of municipal and solid waste landfills to adequately protect human health and the environment with respect to mercury releases.
RESPONSE

The Agency believes that management controls under RCRA for hazardous waste lamps are necessary to minimize releases of mercury and other hazardous constituents to the

environment during lamp accumulation, storage, and transport, to ensure safe handling of such lamps, and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Mercury is high on the Agency=s priority list of toxic pollutants, along with other heavy metals such as cadmium and lead. These metals have been identified as constituents of some waste lamps. The primary health effects from mercury are on the neurological development of children exposed through fish consumption and on fetuses exposed through their mother=s consumption of fish. Therefore, today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273.

The Agency does not have data characterizing the behavior of mercury in different types of landfills over long time periods, although available data from shorter-term studies suggest that mercury can be released to air and groundwater. Data from CERCLA RODs, both that cited at proposal and supplemental data from other sites, show that mercury can be found in municipal landfill leachate, and EPA remains concerned that landfill releases may pose threats over the long term. The Agency has concluded that some management controls are essential for these wastes.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

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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 show clear significant risk to the environment and water consumers. 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 wells in future years.

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As required by the Clean Air Act Amendments of 1990, the Agency issued in 1997 the *Mercury Study Report to Congress*. The study estimates the quantity of mercury emissions to the air from a number of human activities, estimates the health and environmental impacts associated with these mercury emissions, and describes the technologies available to control mercury emissions from these sources. The report concludes that there is cause to seek further reductions in mercury releases and exposures to mercury.

DCN FLEP-00056

COMMENTER International Paper Company
SUBJECT FATE
COMMENT EPA's discussion of the environmental impacts of past disposal of waste lamps clearly shows that management of these wastes in municipal solid waste landfills is protective of the environment. Disposal of lamps into municipal landfills has been the norm for many years and one would expect that if problems were going to occur there would be ample evidence of a problem already documented. Also, the diminishing amount of mercury in the municipal solid waste stream being achieved through pollution prevention activities should further reassure the Agency that the minuscule amount of mercury still present in waste lamps is inconsequential to the environment.
RESPONSE

The Agency believes that management controls under RCRA for hazardous waste lamps are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport, to ensure safe handling of such lamps, and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Therefore, today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273.

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The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well

supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

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now. Mercury leaching from MSWs is a documented problem, as these RODs indicate.

As required by the Clean Air Act Amendments of 1990, the Agency issued in 1997 the *Mercury Study Report to Congress*. The study estimates the quantity of mercury emissions to the air from a number of human activities, estimates the health and environmental impacts associated with these mercury emissions, and describes the technologies available to control mercury emissions from these sources. The report concludes that there is cause to seek further reductions in mercury releases and exposures to mercury.

DCN FLEP-00065
COMMENTER American Fisheries Society
SUBJECT FATE
COMMENT The American Fisheries Society passed the enclosed resolution at its 124th annual meeting in Halifax, Nova Scotia on August 24, 1994. The Society wishes to underscore its resolution by pointing out that while mercury emissions are dominated by combustion sources' the breakage of electric lamps constitutes the predominate source analyzed as "area sources" considered in EPA-453/R-93-048 "National Emissions Inventory of Mercury and Mercury Compounds: Interim Final Report." Although small by comparison, the Society believes that all available means need to be taken to minimize the release of mercury into the environment and to promote recycling. There are at least two reasons for this position.
RESPONSE
In agreement with the commenter, the Agency believes that management controls under RCRA for hazardous waste lamps are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport, to ensure safe handling of such lamps, and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Mercury is high on the Agency=s priority list of toxic pollutants, along with other heavy metals such as cadmium and lead. These metals have been identified as constituents of some waste lamps. The primary health effects from mercury are on the neurological development of children exposed through fish consumption and on fetuses exposed through their mother=s consumption of fish.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with

mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

As required by the Clean Air Act Amendments of 1990, the Agency issued in 1997 the *Mercury Study Report to Congress*. The study estimates the quantity of mercury emissions to the air from a number of human activities, estimates the health and environmental impacts associated with these mercury emissions, and describes the technologies available to control mercury emissions from these sources. The report concludes that there is cause to seek further reductions in mercury releases and exposures to mercury.

DCN SCSP-00077
COMMENTER U.S. Department of Energy
SUBJECT FATE
COMMENT As the preamble to the proposed rule mentions, EPA conducted a study of mercury sources in municipal landfills which indicated that paint residues, thermometers and thermostats were major mercury sources. ("Characterization of Products Containing Mercury in Municipal Solid Waste in the United States, 1970 to 2000," U.S. EPA (April 1992); OSW #EPA530-R-92-013).
RESPONSE

Paint residues, thermometers and thermostats are significant sources of mercury released to the environment. Generators of these materials must determine whether the materials are hazardous wastes when the decision is made to discard the materials. Wastes that exhibit one or more of the characteristics of hazardous waste must be manage as hazardous waste unless the generator is a conditionally-exempt small quantity generator per 40 CFR 261.5. Generators of spent lamps also must determine whether their lamps exhibit a characteristic of hazardous waste. Spent lamps that fail the toxicity characteristic for any constituent or exhibit any other characteristic of hazardous waste are hazardous wastes and are within the scope of today=s final rule, which adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. Note, mercury thermostats are already covered under the universal waste program.

DCN FLEP-00081
COMMENTER Family Dollar Stores, Inc.

SUBJECT FATE

COMMENT We strongly support the conditional exclusion as the best means of ensuring the safe and cost-effective disposal of mercury-containing lamps. EPA studies have shown that mercury does not leach in significant amounts from municipal landfills, making Subtitle C landfilling unnecessary. In addition, in the area of air emissions, Subtitle C does not offer significant protection over that offered by Subtitle D, making the expense of disposal vastly disproportional to the environmental benefit achieved. In fact, U. S. lamps contain less than .2% of total mercury in the environment and account for only 3.8% of total mercury in municipal solid waste. The quantity of mercury potentially released-from landfilling of lamps (.04 to .31 tons) is dwarfed by the emissions of mercury from combustion sources, estimated to be 286 tons per year. Clearly EPA resources are better spent addressing mercury emissions from combustion than in unnecessarily regulating a minor mercury source such as fluorescent lamps.

RESPONSE

Today's final rule adds hazardous waste lamps to the universal waste regulations 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 has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste.

The Agency believes that management controls under RCRA for hazardous waste lamps are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport, to ensure safe handling of such lamps, and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Mercury is high on the Agency=s priority list of toxic pollutants, along with other heavy metals such as cadmium and lead. These metals have been identified as constituents of some waste lamps. The primary health effects from mercury are on the neurological development of children exposed through fish consumption and on fetuses exposed through their mother=s consumption of fish.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with

mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency-s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

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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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

As required by the Clean Air Act Amendments of 1990, the Agency issued in 1997 the *Mercury Study Report to Congress*. The study estimates the quantity of mercury emissions to the air from a number of human activities, estimates the health and environmental impacts associated with these mercury emissions, and describes the technologies available to control mercury emissions from these sources. The report concludes that there is cause to seek further reductions in mercury releases and exposures to mercury.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00087
COMMENTER NECRRRA
SUBJECT FATE
COMMENT NECRRRA understands that USEPA studies have shown that mercury does not leach in significant amounts from municipal landfills, and that United States lamps contain less than .2 percent of total mercury in the environment and account for only 3.8 percent of total mercury in municipal solid waste. Current USEPA regulations incur expensive storage and disposal costs for lamps. The conditional exclusion approach will allow generator selection of properly permitted landfilling or recycling options, and will not impede the implementation of energy-efficient retrofits. NECRRRA strongly supports the conditional

exclusion.

RESPONSE

Today's final rule adds hazardous waste lamps to the universal waste regulations 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 has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. EPA also has found that the universal waste approach will not affect participation in energy-efficient lighting programs.

The Agency believes that management controls under RCRA for hazardous waste lamps are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport, to ensure safe handling of such lamps, and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Mercury is high on the Agency=s priority list of toxic pollutants, along with other heavy metals such as cadmium and lead. These metals have been identified as constituents of some waste lamps. The primary health effects from mercury are on the neurological development of children exposed through fish consumption and on fetuses exposed through their mother=s consumption of fish.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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.

Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

As required by the Clean Air Act Amendments of 1990, the Agency issued in 1997 the *Mercury Study Report to Congress*. The study estimates the quantity of mercury emissions to the air from a number of human activities, estimates the health and environmental impacts associated with these mercury emissions, and describes the technologies available to control mercury emissions from these sources. The report concludes that there is cause to seek further reductions in mercury releases and exposures to mercury.

DCN FLEP-00088

COMMENTER S.C. Johnson and Son, Inc.
SUBJECT FATE
COMMENT 1. Mercury-containing lamps contribute only 3.8% of the total mercury to MSW landfills. It is important to note that 88% of the mercury, placed in MSW landfills is from household batteries. 2. Recent analytical information indicates that mercury is less mobile than previously suspected as a leachate contaminant. Less than 0.01 percent of the mercury in MSW landfills leaches from the landfill. 3. Coal-fired power plants, municipal combustors and medical waste combustors appear to be the major contributors to the increase in mercury air emissions.
RESPONSE

EPA believes that management 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D

units is clearly inappropriate. In addition, the statement that only .01 per cent of mercury in MSWs will leach may not be supportable, and ignores the more important point of whether concentrations which are released could cause substantial harm to human health or to the environment.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

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wells in future years.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN SCSP-00114
COMMENTER National Electric Manufacturers Assn.
SUBJECT FATE
COMMENT NEMA has examined the behavior of lamps containing mercury in quality Subtitle D facilities, particularly landfills, and believes that data exist to suggest that Subtitle C management is not necessary. NEMA has supplied these data to EPA.
RESPONSE

The EPA believes that management 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

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. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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.

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 90th 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.

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 the 1992 analysis. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

DCN SCSP-00118
COMMENTER Robert M. Quintal
SUBJECT FATE
COMMENT GROWING PROBLEM Over 528 million mercury containing lamps per year are disposed of in the United States annually. [4] ["The Management of Spent Electric Lamps Containing Mercury" - NEMA, October 1992.] With increasing usage and conversion to more efficient light sources, this is a growing rather than declining quantity. Mercury is also released through metal emissions of a power plant. With the advent of these newer, more energy efficient light sources, mercury releases as a direct result of power generation are declining. *POWER PLANT EMISSIONS (Over Life of Lamp) 26 mg LAMP MERCURY CONTENT (Present at Disposal) 40 mg *Per lamp, electronic ballasted lighting system lamp life is 20,000 hours. This leaves the growing immediate concern of disposal unchecked. It would seem appropriate that some procedure be enacted to reduce the amount of mercury waste from being landfilled of incinerated.
RESPONSE

The Agency agrees with the commenter that the amount of mercury that is landfilled or incinerated needs to be reduced. Today=s final rule encourages hazardous waste lamp recycling. Generators have several options with regard to waste management, but the ability to access large quantities of universal waste from central collection centers may encourage the development of safe and effective methods to recycle universal waste. In addition, as the demand for lamp recycling grows, recycling would become more cost competitive with Subtitle C landfilling. The EPA believes that increased recycling capacity and continued improvements in technologies could push recycling fees lower.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and

other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN SCSP-00137
COMMENTER Utility Solid Waste Activities Group
SUBJECT FATE
COMMENT In addition, in response to EPA's inquiry regarding the environmental impact from the disposal of lighting waste (id. at 8110), USWAG is aware that a report has recently been prepared for EPA that examines in detail the environmental effects of the disposal of mercury-containing lighting wastes. Research Triangle Institute, "Management of Used Fluorescent Lamps: Preliminary Risk Assessment (Oct. 1992) (incorporated herein by reference). The report reviews an analysis of leachate from municipal landfills (in which mercury-containing lights presumably have been disposed) and found that of 109 measurements, 88 had no detectable levels of mercury. Id. at 86. Of those samples in which mercury was detected, the highest value was 0.0098 mg/l, far below the TC value of 0.2 mg/l. Id. at 88. Therefore, this data demonstrates that the disposal of mercury-containing fluorescent lights in municipal landfills poses little threat to human health and the environment.
RESPONSE

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. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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.

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^{th} 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.

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 the 1992 analysis. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

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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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

The Agency believes that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

DCN SCSP-00140
COMMENTER Advanced Environmental Recycling Corp.
SUBJECT FATE
COMMENT Disposal Concerns of Fluorescent Lamps. Many state agencies and environmentalists continue to ex-press concerns regarding mercury in the environment. A report by Clean Water Fund and Clean Water Action cites recent studies estimating that about 60% of the total global emissions result from human activities and 40% occur naturally (see Exhibit C). Same sources of mercury are the result of a process, while others result from product discard into the municipal waste stream destined for incinerators and landfills. A recent study commissioned by the U.S. EPA has identified electric lighting as the second largest source of mercury in the municipal waste stream.
RESPONSE

The Agency thanks the commenter for the data provided. The Agency believes that management controls under RCRA are needed to minimize the release of mercury from lamps into the environment. EPA also notes that although the commenter is correct that fluorescent lamps are the second largest contributor of mercury to the municipal waste stream, the percentage contributed (roughly 4%) is far less than in batteries. However, batteries have a casing which encapsulates mercury, whereas mercury in lamps is readily available when the lamps are crushed in the landfill. EPA thus agrees with the commenter=s ultimate conclusion that fluorescent lamps

are a significant source of mercury in MSWs.

Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. Although most mercury emissions resulting from human activity 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

DCN FLEP-00145
COMMENTER ASTSWMO
SUBJECT FATE
COMMENT Furthermore, we believe that USEPA has not adequately considered other potential pathways and exposure scenarios which are likely to be affected by the proposed conditional exclusion for fluorescent lamp management. We believe the main threat of mercury in the environment is through the air pathway and deposition of mercury into surface waters. We would like to point out the fact that the federal ambient water quality standard, which is designed to protect against bioaccumulation of mercury in aquatic systems, is established at 12 nanograms per liter or one-two-hundredth (1/200) of the MCL limit of two micrograms per liter (2 [micrograms per liter]).

Mercury is biomagnified in the environment. Mercury is an environmental toxicant and volatile element which cannot be destroyed, and can be transported long distances in the atmosphere from its source. The environmental threat from mercury is compounded due to these factors and the fact that it is biomagnified in the environment as it moves up through the food chain. For these reasons, ASTSWMO is concerned that USEPA may choose to promulgate a national baseline program which would allow municipal solid waste (MSW) landfilling of waste fluorescent lamps via the conditional exclusion proposal. USEPA

may assume that those states which so choose can then promulgate more stringent regulations for waste fluorescent lamps if they deem fit. However, mercury does not recognize State boundaries.

RESPONSE

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 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 has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste.

The Agency agrees with the commenter=s assertion that the main threat of mercury in the environment may be through an air pathway, although empirical data make clear that a groundwater exposure pathway remains a valid concern as well (given that exposure exceeding federal drinking water standards in drinking water wells has been caused by release of mercury from MSWs). Additional EPA studies have concluded that the greatest risks by the air pathway directly attributable to the management of hazardous waste-containing lamps may be associated with the breakage of lamps and the release of mercury to the environment prior to recycling or landfilling. For these reasons, the Agency believes the universal waste program is the best approach for minimizing the impact of hazardous waste lamps on human health and the environment.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00146
COMMENTER Sierra Club/North Star Chapter
SUBJECT FATE
COMMENT THE TRANSPORTATION AND DISPOSAL OF LAMPS ADDS

SIGNIFICANT QUANTITIES OF MERCURY TO THE ENVIRONMENT

According to data from the Minnesota Pollution Control Agency (MPCA), 330 pounds of mercury are released to the environment each year solely from the breakage of fluorescent lamps. Another 1500 lbs comes from garbage incineration. While firm evidence on amounts of mercury from landfill volatilization is lacking, based on evidence from Sweden, the MPCA has estimated that 880 lbs per year come from this source in Minnesota. Mercury containing-lamps are responsible for a significant portion of the mercury being released from these two sources.

RESPONSE

The Agency agrees that the sources mentioned by the commenter are responsible for significant quantities of mercury released to the environment. Today=s final rule adding hazardous waste lamps to the universal waste program in 40 CFR Part 273 will contribute to the reduction of some of these quantities.

The final 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. 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 final rule requires universal waste handlers to manage universal waste lamps in a way that prevents releases of the lamps or the components of the lamps to the environment. Spent lamps must be packed to minimize breakage and packaging materials must be designed to contain potential releases due to breakage during transport. Universal waste lamps must be stored in containers or packages that remain closed, are structurally sound, adequate to prevent breakage, compatible with contents of lamps, and lack evidence of leakage, spillage, or damage that could cause leakage under reasonably foreseeable conditions. Handlers also must contain any universal waste lamps that show evidence of breakage, leakage, or damage that could cause the release of mercury or other hazardous waste to the environment. Universal waste handlers are not allowed to perform lamp crushing.

The Agency believes that recycling is preferable to landfilling. Under the universal waste rule, generators have several options with regard to waste management, but the ability to access large quantities of universal waste from central collection centers may encourage the development of safe and effective methods to recycle universal waste. In addition, as the demand for lamp recycling grows, recycling could become more cost competitive with Subtitle C landfilling. The EPA believes that increased recycling capacity and continued improvements in technologies could push recycling fees lower.

DCN SCSP-00146
COMMENTER Advanced Environmental Recycling Corp.
SUBJECT FATE
COMMENT MERCURY IN THE ENVIRONMENT. Although there has been much written about mercury contamination in the environment, we must again state the fact in our response to the Universal Waste proposal. The USEPA, the regulated community, the states, and the public at large, must do whatever possible to reduce the amount of mercury emissions to the air, land, and water systems. Although many documents detail that the exposure to mercury in humans is related to indirect sources (i.e., the food chain), it must be explicitly stated that the sources of this contamination include various activities, such as process facilities, resource recovery facilities, landfills, and so forth.

The attached exhibits include many studies conducted detailing the contamination in the environment in the United States and Europe. [See hard copy of comment SCSP-00146 for exhibits.] Some of the USEPA's consideration in dealing with mercury-containing devices should be evaluated based on these documents. Many of these documents are based on studies conducted by or in conjunction with the USEPA.

Environmental Considerations - There are many compelling reports and documentation concerning the potential negative environmental impact associated with the improper handling of fluorescent lamps. Unfortunately, there is not a great deal of quantitative studies concerning the impact of fluorescent lamps in uncontrolled landfill environments. Included in the enclosed exhibits are several documents related to these environmental impacts. [See hard copy of comment SCSP-00146 for exhibits.] The most quantifiable and detailed document was prepared by Ward Stone, a New York Department of Environmental Conservation wildlife pathologist. In addition, several European documents are enclosed which are the basis of the specific country's justification for a comprehensive mercury program, including the recycling of fluorescent lamps.

It is apparent that the USEPA has not fully considered the airborne emissions associated with placing mercury-containing

fluorescent lamps into uncontrolled landfill environments. It is clear, based on our qualitative tests and the quantitative conclusions of others, that there will be substantial mercury emissions if placed into a Subtitle D facility. The issue of transportation in a roll-off or standard garbage truck is a major potential for mercury emissions in residential and other areas.

RESPONSE

The Agency agrees with the commenter that mercury releases must be minimized to the extent possible and therefore, today's final rule adds hazardous waste lamps to the universal waste regulations 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) for handlers but requires ultimate disposal at a RCRA Subtitle C hazardous waste or recycling facility. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste.

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. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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.

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^{th} 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.

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 the 1992 analysis. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

DCN SCSP-00154
COMMENTER Lighting Recycling, Inc.
SUBJECT FATE
COMMENT NEMA's argument that lamps are safe when disposed of in controlled landfills has two problems. First, there is little information on the fate of mercury from lamp waste in landfills. If the lamps remain unbroken, it is likely that the mercury will not escape. However, most lamps are broken in the landfill, and the mercury escapes, first at the surface and then underground. How far it migrates and in what form are the unanswered questions. It is well known that mercury's vapor pressure rises steeply with temperature, and that the temperature in municipal land fills can get quite high. More studies need to be done

about exactly where the mercury goes, but in the meantime, EPA should err on the side of safety for waste which clearly fails TCLP for mercury, and should move to keep lamps out of Subtitle D landfills. The other problem with NEMA's landfill argument is that the lamps have to get to the landfill. If the lamps are destined for a landfill, chances are that they will more likely be broken somewhere along the way than if they are destined for a recycling facility licensed only to accept unbroken lamps. Thus the landfill strategy invites less stringent collection, storage ind transportation procedures while recycling encourages procedures which avoid breakage and the consequent release of mercury. Since the proper collection, storage and transport of spent lamps is one of the largest components of management cost, to impose stringent conditions on the front end and then let the lamps go to landfill where they would be broken, and mercury released, would not make sense.

RESPONSE

In agreement with the commenter, the Agency believes that management controls under RCRA are needed to minimize the release of mercury from lamps into the environment and is therefore adding hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

Data available to the Agency show that mercury can be found in municipal landfill leachate in concentrations capable of causing substantial harm and within the range predicted by the TCLP, and EPA remains concerned that landfill releases may pose threats over the long term. The Agency has concluded that some 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 from the management of hazardous waste-containing lamps under several regulatory approaches.

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. 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 current universal waste rule also prohibits universal waste handlers from treating universal wastes (40 CFR '273.11 and 273.31). The crushing of hazardous waste lamps falls within the definition of treatment under RCRA (40 CFR 260.10).

DCN FLEP-00156
COMMENTER National Electrical Manufacturers Assn.
SUBJECT FATE
COMMENT VII. COMMENTS ON RISK CHARACTERIZATION

NEMA is in general agreement with EPA's characterization of the risks associated with the management of spent mercury-containing lamps. When properly crushed, stored, transported, and managed in a state-permitted landfill that meets the standards for raw Subtitle D landfill units, studies show that the risks are likely to be low to non-existent. NEMA believes that there are only three areas of potential concern in the management of spent lamps: 1)air emissions due to mismanagement before ultimate disposal or recycling, 2)air emissions from municipal waste incinerators that do not have mercury controls, and 3)air emissions of mercury during the processing of materials which have been reclaimed from lamps. All of these concerns can be resolved by implementation of the BMPs recommended in Section III of this document.

NEMA also wishes to provide some specific comments on EPA's risk information. 1.It is NEMA's opinion that EPA has overstated the level of protection afforded by Subtitle C because of a failure to recognize that Subtitle C standards are not necessarily protective; for example, stabilization treatment processes are not required to control air emissions. 2.In summarizing the results of EPA's 1988 study on MSW landfill leachate[28] [Footnote 28:28 USEPA 1988. "Summary of Data on Municipal Solid Waste Landfill Leachate Characteristics". EPA/530-SW-88-038. Office of Solid Waste, Washington, D.C.], EPA fails to indicate that many of the leachate samples were below the level of detection for mercury. 3.In its discussion of the December 1989

Swedish study of off-gassing of mercury vapor from landfills, EPA fails to note that the landfills studied contained many unknown industrial wastes. EPA does note that the authors questioned the reliability of their findings given that they were measured near the detection limits of the equipment used. NEMA believes that this study is of extremely limited usefulness. The Swiss study by Baccini, et. al., however, provides useful insights into the behavior of mercury in municipal landfills. If all 27 tons of mercury contained in spent lamps were incinerated each year, available information shows that 1.22 to 24.3 tons, or 4.5 percent to 90 percent of the mercury, could be released, the lower number resulting from incinerators with state-of-the-art mercury controls, the higher number resulting from incinerators that have no mercury controls. Clearly, mercury-containing lamps should not be disposed in municipal incinerators without mercury controls, since most of the mercury in the lamps will be emitted. However, state-of-the-art mercury controls can significantly reduce air emissions and thus municipal incinerators with mercury controls can be considered a viable alternative for lamp disposal. NEMA recommends that EPA consider allowing disposal of lamps in incinerators that meet clean Air Act emissions standards once they are promulgated. EPA could build consideration of this option into the evaluation of the spent lamp management situation required by the NEMA-recommended sunset provision.

6. Landfill Management Facility--necessary to ensure protection of groundwater pathway and air pathway. a. Landfill is lined and has leachate collection system or meets the performance standards for new landfill in Part 258. (This could include an industrial solid waste landfill meeting these requirements.) b. Landfill facility keeps records for three years of number/weight/volume of lamps disposed, generator of shipment, transporter of shipment, and whether lamps were crushed before being disposed in the landfill unit. c. Landfill disposes of crushed lamps in closed drums/containers or landfill disposes of boxed intact lamps in such a manner that breakage and thus air emissions of mercury do not occur.

RESPONSE

Today's final rule adds hazardous waste lamps to the universal waste regulations 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 has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste.

The Agency believes that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) that examines many of the health effects resulting from mercury exposure. Examples of the adverse effect of mercury include neurotoxicological problems and developmental effects in fetus and adults (e.g., AMad Hatters= 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.

EPA does not agree with the commenter that only the air exposure pathway presents significant risks. 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. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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.

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 90th 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.

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 the 1992 analysis. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

Regarding the commenter=s remark about the detection level for mercury in leachate samples, Table 5-4, p. 88 of the RTI study (along with the discussion on p. 86) identifies 88 of the 109 mercury compounds as ABDL@ or below detection limit. However, 24 samples identified no detection limit for the methods used, and these 24 were deleted from the analysis, leaving 85 values, 64 of which were non-detects with specified limits of detection.

The additional data from the CERCLA RODs expands both the number and type of sites examined from the proposal and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

While the Baccini et.al. (1987) study (cited by the commenter) appears to be fairly well conducted and partially relevant to the question of mercury leaching from landfills, it is not definitive on this issue, particularly in light of more recent data. Baccini et.al. measured contaminant concentrations in landfill leachate, and also in landfill gas, from four Swiss landfill units, along with the volume of released landfill leachate and gas. From these data, they calculated the flux, or rate of contaminant release (expressed in nanograms mercury per kilogram of waste per year) from the landfills for several constituents, including mercury. The mercury leachate concentrations measured and flux calculated were relatively low concentrations for mercury. The landfill leachate concentrations ranged from 0.02 to 2.4 micrograms per liter. This concentration range is at least two orders of magnitude lower than the TC regulatory level of 0.2 mg per liter measured using the TCLP test. Commenters appear to cite these data as providing useful insights into mercury behavior in landfills taking these values at face value, and without critically assessing their relevance to MSW landfill conditions and regulations in the United States.

There are two important differences between the Swiss landfills and U.S. MSW landfills that limit the relevance of this study. First, the estimated mercury concentration in the MSW is approximately half that of the US MSW (2 ppm) (Baccini Table 2), compared to 3.6 ppm in the US; see RTI report, p.77). Second, and much more significantly, the Swiss landfill leachate collection system is covered by two to four meters of dense clay, and collects the leachate only after it passes through this clay liner. The ability of this liner to reduce the volume of leachate passing through the landfill, and the concentration of waste contaminants in the leachate are both significant. Liners of this type are not required in Subtitle D waste management units, and the TCLP/TC regulation reflects this fact. The fact of this substantial liner in the Swiss landfills significantly reduces the relevance of the study to U.S. conditions. When viewed in light of data found in CERCLA RODs, the characteristic Scoping Study, and recent preliminary landfill leachate data, Baccini et.al. is quantitatively irrelevant to assessing mercury risks in U.S. MSW and other landfills.

The universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated and disposed in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility. Regarding the commenter-s concern about current treatment requirements, EPA notes that in most cases, treatment of mercury would not involve stabilization, but rather retorting to recover mercury (see RMERC standards for high mercury wastes in Part 268). In addition, EPA notes that permit writers may add omnibus conditions to RCRA Subtitle C permits to deal with potential problems of mercury emissions at given sites. These alternatives are not available if the

wastes are not subject to Subtitle C standards. The Agency is also reviewing current mercury waste treatment standards and recently published an ANPRM soliciting data and comments on the effort (see 64 FR 28949; May 28, 1999).

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN SCSP-00159
COMMENTER Robert K. Stockett
SUBJECT FATE
COMMENT Comment 3: Fluorescent Light Bulbs are Present In Significant Volume in Municipal Waste Stream. It is estimated that approximately 500 to 600 million fluorescent lamps are discarded per year. The largest fraction of these are disposed in municipal waste, typically by mixing with other office, industrial, and household waste [3]. [Footnote 3: Robert S. Truesdale, Stephen M. Beaulieu, Terrence K. Pierson, Ph.D., Management of Used Fluorescent Lamps: Preliminary Risk Assessment, submitted to David Layland, EPA, Oct. 1992.] Electric lighting is estimated to be the second largest source of mercury in municipal solid waste. The contribution of mercury from electric lighting comes from two sources, ordinary fluorescent lamps and high intensity discharge lamps. Of these two sources, fluorescent lamps are by far the largest contributor of mercury. Fluorescent light bulbs are estimated to contribute approximately 26 tons of mercury in solid waste in 1987. All lighting sources are estimated to contribute 27 tons of mercury or 4 percent of the total mercury discards [5]. [Footnote 5: EPA, Characterization of Products Containing Mercury in Municipal Solid Waste in the United States, 1970 to 2000, EPA530-R-92-013, April 1992.] The contribution

of mercury in municipal waste from fluorescent light bulbs is projected to increase through the end of the decade. Businesses in Minnesota are increasing the use fluorescent lighting to save energy and money [6]. [Footnote 6: Minnesota Pollution Control Agency Fact Sheet, What to do with fluorescent and high-intensity discharge lamps, Oct. 1992.] While the average mercury content per bulb has been reduced over the past five years; the anticipated growth in the use of fluorescent lamps will cause the total mercury discards to increase. The percent contribution of mercury in municipal solid waste from fluorescent light bulbs is expected to increase from 3.7 to 4.7 percent levels in the years 1970 through 1989 to 13.3 percent in 1995 and 23 percent in 2000. The following table shows the projected increase in mercury from electric lighting [5]. [EPA, Characterization of Products Containing Mercury in Municipal Solid Waste in the United States, 1970 to 2000, EPA530-R-92-013, April 1992.] [See hard copy of SCSP-00159 for table.] The projected increase of mercury in solid waste from fluorescent light bulbs will more than double mercury emissions in municipal waste incinerator flue gases from 3.5 metric tons in 1987 to 7.7 metric tons in 1995 (see attachment 1) [5].

RESPONSE

The Agency thanks the commenter for the data and agrees with the commenter that the relative contribution of mercury by lamps in the municipal waste stream will continue to increase as more relamping occurs and as the mercury content of batteries declines. EPA also views the contribution as being an environmentally significant volume, as pointed out by the commenter. Therefore, today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The universal waste rule will reduce the cost of managing spent lamps, which should result in a greater number of lamps being collected and recycled and fewer hazardous waste lamps being mismanaged in the municipal solid waste stream.

DCN FLEP-00160
COMMENTER Central and South West Services, Inc.
SUBJECT FATE
COMMENT 1. The Existing TC Mis-characterizes Lighting Wastes. As an initial point, EPA itself 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 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 well depending on the distance to the well." Id. 2. The Management of Mercury-Containing Lamps in MSWLFs Does Not Impact Groundwater Quality From a technical perspective, the record evidence demonstrates convincingly that, when managed in MSWLFs, mercury-containing lamps do not pose a threat to human health and the environment and thus do not want regulation as a hazardous waste. See 59 Fed. Reg. at 38290-91. The RTI Report One of the most compelling record documents that provides technical support for the conditional exclusion is the comprehensive risk assessment prepared on behalf of EPA by the Research Triangle Institute ("RTI"), entitled "Management of Used Fluorescent Lamps: Preliminary Risk Assessment," Docket No. FLEP-S0019 (the "RTI Report"), assessing the groundwater impact related to the management of mercury-containing lamps in MSWLFs. The RTI Report provides a detailed analysis of the "magnitude and impacts of environmental releases of mercury that are occurring during the management (i.e., landfill disposal, incineration, and recycling) of used fluorescent lamps." RTI Report at 82. The RTI Report provides persuasive evidence that lighting wastes have been, and can continue to be, safely managed in MSWLFs. The conclusions in the RTI Report apply to both low- pressure fluorescent lamps and high intensity discharge lamps. The RTI Report concludes, among other things, that: (1) "Most mercury entering [MSW] landfills is retained within the waste and that the amount of mercury released from the MSW waste stream via leachate is insignificant." Id. at 101. (2) "Mercury is present at low concentrations in MSW landfill leachate, with a mean concentration of 0.0008 mg/L and a maximum measured value of 0.0098 mg/L." Id. at 112-13. These numbers are far below the TC regulatory level for mercury of 0.2 mg/L. See 59 Fed. Reg. at 38291. (3) "Considering the very low concentrations of mercury measured in [MSW] landfill leachate and the ability of soils and aquifer materials to retain at least some amount of mercury, it is reasonable to conclude that the impacts of mercury in MSW landfill leachates on groundwater quality is negligible." RTI Report at 104 (emphasis added). See 59 Fed Reg. at 38291 ("EPA has identified studies that indicate

> that municipal solid waste has a significant capacity for retaining mercury in the landfill unless there are unusually large quantities of mercury in municipal solid waste"). (4) In conclusion, significant impacts to ground-water quality from mercury in leachate from MSW appear to be extremely rare.... Considering that mercury-containing lamps and batteries have been part of the MSW stream for many years, and that all landfills in the U.S. have their share of these wastes, it can be concluded that mercury in such wastes is not readily released by leaching processes that occur in the MSW landfill environment. This conclusion is further supported by controlled leaching studies of mercury-containing wastes codisposed with MSW. RTI Report at 111 (emphasis added). (5) "Extracts and leachates from MSW ash also show low mercury levels." Id.. at 113.
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> This compounding evidence has led EPA to correctly conclude that "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 MSW landfill environment." Id. This conclusion is consistent with EPA's reassessment of the mercury TC regulatory level which, as discussed above, indicates that mercury is not as mobile in the subsurface environment as previously suspected and that the current TC regulatory level of 0.2 mg/L may be overly conservative and may inappropriately characterize mercury-containing lighting wastes as hazardous. See 59 Fed. Reg. at 38239 (explaining that the TC "regulatory limits for mercury if re-assessed using the MINTEQ model, when completed, night be higher (less stringent) than the current limits because mercury may less mobile than the current TC rule indicates").

RESPONSE

In the 1994 proposal for spent mercury-containing lamps, the Agency noted that the Agency was conducting long-term studies on the fate and transport of toxicity characteristic (TC) metals in ground water, and that the TC regulatory levels for mercury may be changed when that work is completed. EPA also stated, however, that further investigation of data (including that submitted in public comments) was needed to draw firmer conclusions about the fate of mercury in MSW leachate (see 59 FR at 38291).

The Agency believes that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage,

and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 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^{th} percentile compared with 85^{th} 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.

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) (AEdison@). 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 that this is

clearly a reaonable 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 featrues of the TC (i.e., the leaching procedure plus 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 they are crushed after disposal in landfill cells; 2) mercury is in a leachate and water-soluble form in lamps; and 3) monitoring data from MSWLs confirm that mercury has escaped from the landfill unit, 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. It is also clear that the crushing feature of the TCLP protocol is warranted, since lamps will be broken in landfills and mercury is potentially mobilizable at that point. The commenter-s main point appears to be that the fate and transport features of the TC are not warranted due to purported immobility of mercury in a municipal landfill environment. Actual field data, however, show that MSWs do not have attenuative mechanisms which preclude mercury mobilization, escape and release in high concentrations. Indeed, the concentrations found in actual damage incidents is in many cases within the same order of magnitude as predicted by the TC -- i.e. an appreciable fraction above the federal drinking water standard, including, in some cases, at receptor points more distant than the 500 feet used in the TC model. Thus, EPA cannot accept the comment that the TCLP is so overpredictive as not to be rationally related to the potential hazardousness of the disposed lamps at issue in this rulemaking.

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.

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. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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.

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^{th} 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.

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 the 1992 analysis. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

DCN FLEP-00162
COMMENTER Delaware Department of Natural Resources
SUBJECT FATE
COMMENT MERCURY IS INCREASING AND BIOACCUMULATING IN THE ENVIRONMENT

> The Delaware HWMB is concerned that an exclusion of mercury containing lamps would be inconsistent with current federal and state policy to decrease mercury emissions and reduce bioaccumulative chemicals in the environment. Mercury in leachate and gas emissions from municipal solid waste (MSW) landfills can have a significant effect, especially when the cumulative impact is considered. The presence of inorganic mercury and microorganisms (such as in a landfill), produces methyl mercury, a form of mercury that is more bioaccumulative in the environment. Since neither the production of methyl mercury, nor the mercury leachate process in MSW landfills is well documented or understood, the Delaware HWMB feels the need to limit mercury containing wastes in landfills. Even the U.S. EPA states, "The behavior of mercury in a MSW landfill is not known in great detail." The Delaware HWMB believes that mercury containing lamps should be properly managed outside of a MSW landfill at least until it can definitely be shown that the lamps will not pose any harm when managed as a MSW.

RESPONSE

The Agency agrees with the commenter regarding the concerns associated with the proposed conditional exclusion option. 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 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 has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities.

The Agency believes that management 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water

consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

The Agency agrees with the commenter that under reducing conditions, and with the presence of bacteria in the MSWL, methyl mercury can be formed, although formation rates and specific conditions favoring its formation are not well studied. Methyl mercury is of concern because of its ability to bioaccumulate. Therefore, while the reducing conditions of MSWLs may reduce divalent to elemental mercury, the elemental mercury will not remain harmlesssly in the landfill. The subsequent formation of toxic methyl mercury means that environmental risk is likely to persist (see *Mercury Report to Congress*, vol. 1, p. 3-22 to 3-43.)

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).

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) (AEdison@). 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 that this is clearly a reaonable 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 plus 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 they are crushed after disposal in landfill cells; 2) mercury is in a leachate and water-soluble form in lamps; and 3) monitoring data from MSWLs confirm that mercury has escaped from the landfill unit, 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. Further information on environmental fate and transport, discussed above, confirm the possibility of mobilized mercury being released from MSWs to contaminate groundwater and to reach human or other receptors in potentially harmful concentrations. 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).

DCN FLEP-00169
COMMENTER Advanced Environmental Recycling Corp.
SUBJECT FATE

COMMENT MERCURY IN THE ENVIRONMENT: Mercury contamination in the environment has been greatly documented for the past several years, in particular, the environmental hazards associated with mercury-containing lighting devices. An increasing amount of data and information is available on a routine basis. In reviewing the pathogens of mercury through improper handling of waste mercury lighting devices, we must scientifically consider the issues, while practically evaluating them. Unfortunately, there is not a great deal of scientific information concerning point source discharges of mercury through leachate collection, landfill gases or direct airborne releases in landfill operations located in the United States. We believe that organizations opposing the Universal Waste option has been shortsighted in their evaluation of the potential of mercury releases in each of these areas. The fact that there may not be valid scientific data available does not directly relate to a lack of hazard. In fact, it may merely postpone identification for a later date. From a rhetorical perspective, how many remediation projects are currently in effect today based on the lack of our ignorance or scientific data from the 1960s and 1970s. The major difference today is that we understand a great deal about mercury, its hazards, reactions, and ability to release in the environment. It would be irresponsible for us, as a regulated community, to encourage the use of options for treating disposal or recycling of lamps which does not minimize the overall environmental impact of mercury. Nonhazardous waste landfilling is an irresponsible approach.

RESPONSE

The Agency agrees with the commenter that disposing of hazardous waste lamps in Subtitle D landfills is not the most desirable option. Today's final rule adds hazardous waste lamps to the universal waste regulations 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 has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities.

DCN FLEP-00170
COMMENTER National Assn. of Energy Services Comp.
SUBJECT FATE

COMMENT At the outset, we note that the disposal of mercury-containing waste presents a complicated set of issues, made even more difficult by the fact that data on some of the key issues, such as emissions levels and air transport of mercury vapor, are scarce. While it does appear, based upon the data available, that landfill disposal of mercury does not present an immediate problem with respect to leaching, the concentration of mercury in landfills does raise long-term environmental questions. Furthermore, with a fragile waste such as lamps, other issues must be addressed, the most notable of these being breakage during transport, crushing or landfill disposal. In addition, where recycling is chosen, the subsequent use of glass to which mercury has adhered may require more careful research and proactive management.

RESPONSE

The Agency agrees with the commenter that disposing of hazardous waste lamps in Subtitle D landfills is not the most desirable option. Today's final rule adds hazardous waste lamps to the universal waste regulations 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) yet still require handlers to minimize releases and prevent breakage of hazardous waste lamps. The Agency has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA,* 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

The Agency also 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 storage facilities, although the Agency does not regulate the actual process of reclaiming mercury. In addition, recycling facilities (as well as Adownstream@ 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).

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-00171
COMMENTER Monsanto Company
SUBJECT FATE
COMMENT At the same time that these costs are being incurred, it is now very apparent from Agency and industry data that the management of Hg-lamps as hazardous is not warranted, and that environmental benefit would in fact occur if the lamps were managed in Subtitle D landfills. Data provided by NEMA demonstrates that mercury recycling activity causes airborne emissions estimated at 3% of the processed (contained) mercury, whereas landfill of Hg-lamps would result in maximum leakage of

only 1.2%, as follows: Lamp broken en route to disposal
1.15 % Gas releases from landfill (10 years)
0.01 Leachate releases from landfills (10 yrs)
0.007 1.167%

RESPONSE

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. 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) yet still requires handlers to minimize releases and prevent breakage of hazardous waste lamps, meeting one of the commenter=s concerns.

The Agency believes that management 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D

units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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-containing lamps under several regulatory approaches. Table 3-2 of the analysis indicates that mercury air emissions are likely to be lower under any of the universal waste implementation options evaluated as compared with either current practice (baseline) or the conditional exclusion option (which allows Subtitle D disposal).

The Agency also 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 storage facilities, although the Agency does not regulate the actual process of reclaiming mercury. In addition, recycling facilities (as well as Adownstream@ 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).

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-00172
COMMENTER Natural Gas Pipeline Company of America
SUBJECT FATE
COMMENT ENVIRONMENTAL RISK/COST BENEFIT USEPA studies have indicated that approximately 643 metric tons of mercury are discarded in MSW landfills annually with the majority coming from household batteries, thermostats and thermometers. Estimates indicate that approximately 20 metric tons of mercury will be added annually to these landfills if all the mercury containing bulbs are disposed of in MSW landfills. This represents only . 3% of the total mercury placed in these landfills at the present time. Studies conducted by the Office of Solid Waste in 1988 indicated that only six leachate samples out of 109 from MSW landfills exceeded the drinking water maximum contaminant level for mercury (0.002 mg/1) and none were above the Toxicity Characteristic limit for mercury (0.2 mg/1) with the average being 0.0008 mg/l. Other studies have indicated that less than 0.01 percent of the mercury in MSW landfills leaches from the landfill. The Resource Conservation and Recovery Act (RCRA) defines waste as "hazardous" if the waste poses "substantial

present or potential hazard" to human health and the environment. As described above, disposing of these wastes in permitted MSW landfills does not result in the level of environmental risk that warrants their designation as "hazardous".

RESPONSE

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. 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 believes that management 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

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. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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.

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^{th} 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.

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 the 1992 analysis. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

DCN FLEP-00173
COMMENTER Advanced Environmental Technology Corp.
SUBJECT FATE

COMMENT Mercury is a highly toxic heavy metal found to be a problem in landfills and resource recovery facilities. Mercury bioaccumulates in the food chain and has been found to typically enter the food chain from water sources through air deposition. The metal vaporizes at room temperature and is absorbed into water. Municipal disposal of fluorescent lamps makes the mercury which is securely contained in the articles available to the environment because of crushing or burning the devices.

The USEPA has identified fluorescent lamps as the second largest source of mercury in the municipal solid waste stream. Although these materials are hazardous wastes by the Toxic Contaminant Leaching Procedure (TCLP), the vast majority of the regulated and unregulated community manage these wastes through municipal facilities. This is due to a lack of awareness and/or fear of the existing regulatory system.

RESPONSE

The Agency agrees with the commenter that disposing of hazardous waste lamps in Subtitle D landfills provides inadequate protection of the environment, and that mercury can be released to the air and groundwater from Subtitle D landfills, as indicated by the Agency=s review of CERCLA RODs, the 1996 Hazardous Waste Characteristics Scoping Study, and recent landfill leachate data. 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. 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).

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. 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 current universal waste rule also prohibits universal waste handlers from treating universal wastes (40 CFR '273.11 and 273.31). The crushing of hazardous waste lamps falls within the definition of treatment under RCRA (40 CFR 260.10).

DCN FLEP-00174
COMMENTER Illuminating Engineering Soc. of N. Am.
SUBJECT FATE
COMMENT Support for Conditional Exclusion The IESNA supports the conditional exclusion as the best means of ensuring the safe and

cost-effective disposal of mercury-containing lamps. EPA studies have shown that mercury does not leach in significant amounts from municipal landfills, making Subtitle C landfilling unnecessary. (A trend towards stricter requirements on landfills themselves, such as the use of liners, is complimentary to this disposal method.) In addition, in the area of air emissions, Subtitle C does not offer significant protection over that offered by Subtitle D, making the expense of disposal disproportional to the environmental benefit achieved. Industry statistics indicate that U.S. lamps contain less than 0.2% of total mercury in the environment and account for only 3.8% of total mercury in municipal solid waste. Note should be taken of industry's successful efforts at reducing the amount of mercury contained in lamps. The quantity of mercury potentially released from landfilling of lamps (0.04 to 0.31 tons) is dwarfed by the emissions of mercury from combustion sources, estimated to be 286 tons per year.

RESPONSE

The EPA believes that management controls under RCRA are needed to minimize the release of mercury from lamps into the environment. 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. The universal waste rule provides a reduced, or streamlined set of requirements (i.e., the universal waste rule is less stringent than full Subtitle C management standards).

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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to

groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency-s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

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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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

DCN FLEP-00179
COMMENTER Environmental Defense Fund
SUBJECT FATE
COMMENT Background: Mercury poses a serious hazard to the environment and human health because of three characteristics: 1) the element can be easily volatilized due to the high vapor pressure of its elemental form and can thus become widely dispersed, 2) inter-conversions from the elemental form to mercury compounds are relatively easy, and 3) methylated mercury is readily bioaccumulated in animals and plants. Mercury's mobility, ability to become methylated, and its high bioaccumulation potential together cause the inputs of many small mercury release sources to produce toxic levels of mercury in biota such as fish [1] [Footnote 1: "Management of Used Fluorescent Lamps: Preliminary Risk Assessment," Research Triangle Institute for U.S. EPA Office of Solid Waste, October 1992 (revised May 1993).] consumption bans or advisories due to mercury as of 1990 (59 Fed. Reg. 38291). In Minnesota, 94% of the lakes surveyed have restrictions on fish consumption issued by the Minnesota Department of Health. [2] [Footnote 2: "Strategies for Mercury Control in Minnesota, " Minnesota Pollution Control Agency Mercury Task Force, St. Paul, MN, 1994, p. 1.] Twenty-two states have documented mercury contamination of fish, even though not all states have tested their fish. [3] [Footnote 3: "Strategies for Mercury Control in Minnesota, " Minnesota Pollution Control Agency Mercury Task Force, St. Paul, MN, 1994, p. 13.] Studies of the natural biological processes that interconvert organic and inorganic forms of mercury are in their infancy, but the

risks posed by methyl mercury are known to be significant. The sources of methyl mercury in rainfall are unknown, and few studies have examined potential vapor phase release of organo-mercury compounds from municipal solid waste landfills. The possibility that such landfills could, at some stage of their life, inject gaseous form or as part of leachate requires further study. [4] [Footnote 4: EPA states in the preamble to the proposed rule that "The behavior of mercury in a MSW (municipal solid waste) landfill is not known in great detail" (59 Fed. Reg. 38291).] Moderate concentrations of vapor phase mercury from municipal solid waste landfills have been detected in one recent study, but speciation data were absent. [5] [Footnote 5: "Strategies for Reducing Mercury in Minnesota," op. cit., p. 36.] The continuing development of techniques capable of measuring speciated and total mercury underscores the immaturity of our current understanding of mercury movement throughout the environment. [6] [Footnote 6: See, for example, abstracts from the International Conference on Mercury as a Global Pollutant, July 10-14, 1994, Whistler, British Columbia. (Proceedings not currently available.)] Because of our inadequate scientific understanding of mercury movement throughout the environment, all parties--including the lamp manufacturing industry--agree that incineration of mercury-containing lamps at the present stage of municipal incinerator technology is not a viable option. Flue gas cleanup technology removes less than 90% of the mercury, while the free elemental mercury and mercuric halides produced in a municipal incineration are known to be mobile in the environment, which can result in atmospheric deposition of mercury in surface water bodies.

RESPONSE

EPA agrees with the commenter that not enough is known about the long term potential of landfill releases of mercury to pose a threat to human health and the environment. As described in the *Mercury Report to Congress* (vol. 3, chapter 2), mercury does interconvert between elemental, divalent, and organic forms in the environment. 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. 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).

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. 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 current universal waste rule also prohibits universal waste handlers from treating universal wastes (40 CFR '273.11 and 273.31). The crushing of hazardous waste lamps falls within the definition of treatment under RCRA (40 CFR 260.10). The management controls and final disposal requirements are expected to reduce the risks of mercury releases to the environment mentioned by the commenter.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

The Agency=s 1997 Report to Congress presents our current understanding of mercury fate and transport, cycling through the environment, and environmental chemistry. Data on landfill releases of mercury to ground water and surface water are also presented in CERCLA RODs reviewed by the Agency, the 1996 Hazardous Waste Characteristics Scoping Study, and recent preliminary landfill leachate data.

DCN FLEP-00180
COMMENTER Food Marketing Institute
SUBJECT FATE
COMMENT Therefore, FMI is pleased EPA is recognizing that current data indicates mercury from spent lamps does not pose a threat to the environment --- as long as the lamps are not incinerated. Continuing to treat mercury-containing lamps as a hazardous material only serves to maintain costly disposal requirements for generators and to discourage efficiency efforts like EPA's

own Green Lights program.

RESPONSE

The Agency notes that it does not dismiss the risks of mercury releases to the environment from sources other than incinerators. On the contrary, the EPA believes that management controls under RCRA are needed to minimize the release of mercury from lamps into the environment and therefore is adding hazardous waste lamps to the universal waste regulations in 40 CFR Part 273. 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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.

Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

All field studies identified by the Agency to date have tried to assess total mercury behavior (from all sources) in landfills in proportion to lamp contribution to total mercury in the landfill. There are no 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 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. 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).

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-containing lamps under several regulatory approaches. As shown in the economic analysis supporting today=s rulemaking, the Agency believes the decision to use energy efficient lighting is independent of the waste management options for hazardous waste lamps.

DCN FLEP-00181
COMMENTER Exxon Chemical Americas
SUBJECT FATE
COMMENT EPA studies have shown that mercury does not leach in significant amounts from landfills, thereby presenting little or no risk to human health and the environment.
RESPONSE

The Agency believes that management 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad

Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

DCN SCSP-00181
COMMENTER General Electric Company
SUBJECT FATE
COMMENT The mercury present in fluorescent lamps does not pose a substantial risk when disposed of in existing municipal waste landfills, let alone Subtitle D facilities. This conclusion is supported strongly by a recent EPA study which indicates that most of the mercury entering a landfill is retained within the waste and that the amount of mercury released from the municipal solid waste ("MSW") stream via leachate is insignificant.[12] [Footnote 12: Robert S. Truesdale, Stephen M. Beaulieu, Terrence K. Pierson, Management of Used Fluorescent Lamps: Preliminary Risk Assessment, (Research Triangle Institute, 1992), pp. 82-112.] In fact, the study concludes that the release rate for mercury in landfill leachates is low, with estimates of about 0.0007 percent of the MSW mercury input being released to the environment annually.[13] [Footnote 13: Furthermore, risks from lamps will decrease to an even lesser level in the near term as manufacturers of fluorescent lamps continue to reduce their total mercury content and with the implementation of the recently promulgated Part 258 municipal solid waste landfill standards.] This equates to a mean concentration of 0.0008 mg/l and a maximum measured value of

0.098 mg/l, which is well below the TC regulatory limits for mercury.

RESPONSE

The Agency agrees with the commenter regarding the continued reduction in the total amount of mercury used in the manufacturing of lamps. However, while the total mercury in lamps may be reduced over time, the total amount of mercury available to the environment may increase as more relamping occurs. EPA believes that disposal of hazardous waste lamps in Subtitle D landfills represents a concern due to the potential for releases of mercury (and other hazardous constituents) to the environment during storage, transport, and disposal.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

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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 per year of mercury (see Table 4-1 of the RTI study, 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 up to 0.02% per year (p. 101 of the RTI report) the data as a whole may indicate that a significant reservoir of mercury remains in the landfills to contaminate groundwater wells in future years.

The Agency believes that management 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

DCN FLEP-00187
COMMENTER PacifiCorp
SUBJECT FATE

COMMENT Briefly, PacifiCorp's major comments and recommendations are as follows: (1)The record evidence demonstrates convincingly that, when managed in MSWLFs, mercury-containing lamps do not pose a threat to human health and the environment. According to EPA's own data, the annual amount of lamp-related mercury to escape from landfills nationwide is less than 4 pounds. The continued regulation of the materials under the hazardous waste program is therefore both unnecessary and counterproductive.

RESPONSE

The Agency believes that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Therefore, today=s rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well

supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. Estimates of total mercury released from landfills (regardless of accuracy) are similarly irrelevant. Even the Agency=s initial under-estimate of total lamp mercury released in landfill leachate of 0.0032 megagrams per year (p. 103 of the RTI report) is equal to seven pounds, which is roughly double the commenter=s estimate. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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-containing lamps under several regulatory approaches.

DCN FLEP-00187
COMMENTER PacifiCorp
SUBJECT FATE
COMMENT A. The Rulemaking Record Demonstrates Conclusively That Mercury-Containing Lamps Do Not Warrant Hazardous Waste Regulation. The data in the rulemaking record and the additional data provided with these comments by the Electric Power Research Institute ("EPRI" demonstrate that mercury-containing lighting wastes can be safely managed in MSWLFs or at qualified recycling facilities without posing a threat to human health or the environment. EPA is thus fully justified in adopting the conditional exclusion for mercury-containing lamps.

2.The Management of Mercury-Containing Lamps In MSWLFs Does Not Impact Groundwater Quality. The record evidence demonstrates convincingly that mercury-containing lamps, when managed in MSWLFs, do not pose a threat to human health and the environment and thus do not warrant regulation as a hazardous waste. See 59 Fed. Reg. at 38290-91. One of the most compelling record documents that provides technical support for the conditional exclusion is the comprehensive risk assessment prepared on behalf of EPA by the Research Triangle Institute ("RTI"), entitled "Management of Used Fluorescent Lamps: Preliminary Risk Assessment," Docket No. FLEP-S0019 (the "RTI Report"), assessing the groundwater impact related to the management of mercury-containing lamps in MSWLFs. The RTI Report provides persuasive evidence that lighting wastes have been, and can continue to be, safely managed in MSWLFs. The conclusions in the RTI Report apply to both low-pressure fluorescent lamps and high intensity discharge lamps. The RTI Report concludes that: (1) Only an "insignificant" amount of mercury leaches out of MSW landfills: "Mercury is present at low concentrations in MSW landfill leachate, with a mean concentration of 0.0008 mg/L and a maximum measured value of 0.0098 mg/L." Id. at 112-13. These

numbers are far below the TC regulatory level for mercury of 0.2 mg/L. See also 59 Fed. Reg. at 38291. (2) "Considering the very low concentrations of mercury measured in [MSW] landfill leachate and the ability of soils and aquifer materials to retain at least some amount of mercury, it is reasonable to conclude that the impacts of mercury in MSW landfill leachates on groundwater quality is negligible." RTI Report at 104 (emphasis added). See also 59 Fed. Reg. at 38291 ("EPA has identified studies that indicate that municipal solid waste has a significant capacity for retaining mercury in the landfill unless there are unusually large quantities of mercury in municipal solid waste"). (3) "In conclusion significant impacts to groundwater quality from mercury in leachate from MSW appear to be extremely rare, .. Considering that mercury-containing lamps and batteries have been part of the MSW stream for many years, and that all landfills in the U.S. have their share of these wastes, it can be concluded that mercury in such wastes is not readily released by reaching processes that occur in the MSW landfill environment." RTI Report at 111 (emphasis added). (4) "There is little, if any, evidence of adverse impacts of mercury in MSW on ground-water resources" and "no significant human exposure to mercury is likely to result from MSW landfill leachate contamination of ground water." at 101, 166 (emphasis added). These findings compel the conclusion that management of mercury-containing lamps in MSW landfills does not present a significant risk to human health and the environment. EPA itself has reached a similar conclusion: "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 MSW landfill environment." 59 Fed. Reg. at 38291. In fact, using EPA's calculations, annual leaching of mercury from MSWLFs nationwide amounts to less than 4 pounds. This conclusion is consistent with EPA's reassessment of the mercury TC regulatory level which, as discussed above, indicates that mercury is not as mobile in the subsurface environment as previously suspected and that the current TC regulatory level of 0.2 mg/L may be overly conservative and may inappropriately characterize mercury-containing lighting wastes as hazardous. See 59 Fed. Reg. at 38239. [2] [Footnote 2: PacifiCorp points, in addition, to the Tetra Tech Report, entitled "Information on Fate of

> Mercury from Mercury- Containing Lamps Disposed in Landfills," submitted with the comments of the Utilities Solid Waste Advisory Group. The Tetra Tech study found that all predicted concentrations of mercury at down gradient drinking water wells located at a distance of 150 meters from the MSWLF were far below the mercury MCL of 0.002 mg/L.]
>
> B. Subjecting Mercury-Containing Lamps That Are Managed in MSWLFs to Subtitle C Regulation Would Be Inconsistent with the Record and Arbitrary and Capricious The above groundwater and air emission data demonstrate convincingly that the management of mercury-containing bulbs in MSWLFs, as they have been for years without resulting in any "significant human exposure," will not, have any adverse impact on human health or the environment. The disposal of mercury-containing lamps in qualified 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. The Agency itself recognizes this point. 59 Fed. Reg. at 38293 ("The available data on landfill leachate suggests 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, there is no technical or legal basis for regulating mercury-containing lamps under Subtitle C of RCRA because of groundwater concerns. [4] [Footnote 4: PacifiCorp wishes to re-emphasize the point that mercury's TC regulatory levels -- and thus the determination of whether it is hazardous - are predicated upon the assumption that the mercury will reach drinking water receptors at concentrations above the relevant MCLs. See 55 Fed. Reg. 11798 (March 29, 1990); 59 Fed. Reg. at 38288. The record evidence makes clear, however, that this assumption is unfounded in the case of managing mercury-containing lamps in MSWLFs.]

RESPONSE

The Agency believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

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. 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).

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. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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.

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 90th 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.

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 the 1992 analysis. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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).

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) (AEdison@). 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 that this is clearly a reaonable 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 plus 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 they are crushed after disposal in landfill cells; 2) mercury is in a leachate and water-soluble form in lamps; and 3) monitoring data from MSWLs confirm that mercury has escaped from the landfill unit, 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. Further information on environmental fate and transport, discussed above, confirm the possibility of mobilized mercury being released from MSWs to contaminate groundwater and to reach human or other receptors in potentially harmful concentrations. 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).

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 (90th percentile compared with 85th 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.

With respect to the Tetra Tech study cited by the commenter, the Agency notes that this study used modelling which predicted concentrations of mercury far below the maximum contaminant level (MCL) for drinking water at downgradient drinking water wells (located at 150 meters from the municipal solid waste landfill). The modelling used in this report was used to estimate the impacts on air and groundwater solely from the disposal of mercury-containing lamps in municipal landfills. The commenter is correct that mercury from lamps is only an incremental part of the loading and risks associated with total mercury (from all sources) found in landfills. This statement would be true of most other sources of mercury in landfills and is also true of many hazardous waste constituents regulated under RCRA. EPA believes that wastes failing the TCLP for mercury will generate leachate that will contribute to well contamination sufficiently to be identified and regulated as hazardous wastes. In addition (as discussed in more detail in the AToxicity@ section of the response to comments to this rule), the most recent data available to the Agency demonstrate greater mobility of mercury than previously thought. Mercury from lamps also appears to be readily available (compared to other sources) due to crushing in the landfill, and under certain landfill conditions is likely to solubilize and leach (see Memorandum To The Record from Gregory Helms entitled ASolubility of Mercury Salts@, dated June 18, 1999).

Other aspects of the study also tend to minimize the possibility of the model showing exceedances of the MCL at a well, such as use of a deterministic model, short leaching duration, high retardation factors, and small landfill. However, calculating only the incremental contribution of lamp mercury to mercury well contamination and then concluding that lamps are not a problem ignores the cumulative impact of all mercury waste sources on the environment, to which lamps are a contributor. The Agency does not routinely exempt from regulation so-called Aminor sources@. If there were 24 other Aminor sources@ of mercury, each contributing 4% to the total (the approximate contribution of lamps), they would constitute virtually the whole contribution. The Agency clearly would not grant each of the sources an exemption as a minor source, nor would EPA consider such an exemption for spent lamps.

DCN FLEP-00190
COMMENTER Browning-Ferris Industries
SUBJECT FATE
COMMENT 2.1 Net Reductions in Mercury Emissions: The Agency also has estimated a reduction in mercury emissions of 9.7 Mg per year

due to lower power demand if the Green Lights program is fully implemented. Importantly, this 9.7 Mg per year reduction is far greater than EPA's estimated 0.2 Mg per year that may be released to ground water if all mercury-containing lamps were to be landfilled in non-subtitle C landfills. Similarly, the Agency estimates that, under current air emission regulations, municipal waste combustors (MWC) release 2.9 Mg of mercury per year due to the combustion of mercury containing lamps. However, the amount of mercury emitted into the atmosphere due to MWCs is expected to decrease by 80 to 90 percent when the recently proposed air emission standards for MWCs are promulgated (See 59 FR 48198 and 59 FR 48228).

4.3 Mercury From Lamps Is Only A Fraction Of the Mercury Disposed of in Municipal Landfills. The amount of mercury disposed of in municipal solid waste landfills is estimated by the Agency to be approximately 643 metric tons per year. In addition, the Agency estimates that exempting mercury-containing lamps entirely from the hazardous waste system would increase the amount of mercury entering landfill by approximately three percent assuming that none of the these lamps are recycled or are incinerated. There is no reason to believe that an increase of such a small magnitude would cause the concentration level of mercury in municipal landfill leachate to increase to levels of concern.

RESPONSE

The Agency believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

Therefore, 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. 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).

However, EPA notes that groundwater contamination from disposal in non-Subtitle C landfills is also a pathway of concern. The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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-containing lamps under several regulatory approaches.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA,* 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00191
COMMENTER Utility Solid Waste Activities Group
SUBJECT FATE
COMMENT 1.The Management of Mercury-Containing Lamps in MSWLFs Does Not Impact Groundwater Quality. The modeling and analytical results demonstrating that mercury-containing lamps do not warrant hazardous waste regulation are confirmed by studies demonstrating that mercury does not migrate from existing MSWLFs in quantities that pose a threat to human health and the environment. 59 Fed. Reg. at 38290-91. Moreover, migration of mercury from landfills attributable to spent lamps will decrease even further in the future because the continued reduction in the total amount of mercury used in the manufacture of lighting technology. Id. at 38290. a. The RTI Report One of the most compelling record documents that provides technical support for the MSWLF option is the comprehensive risk assessment prepared on behalf of EPA by the Research Triangle Institute ("RTI"), entitled "Management of Used Fluorescent Lamps: Preliminary Risk Assessment," Docket No. FLEP-S0019 (the "RTI Report"). This report assesses the groundwater impact related to the management of mercury- containing lamps in MSWLFs and provides a detailed analysis of the "magnitude and impacts of environmental releases of mercury that are occurring during the management (i.e., landfill disposal, incineration, and recycling) of used fluorescent lamps." RTI Report at 82. The RTI Report provides persuasive evidence that lighting wastes have been, and can continue to be, safely managed in MSWLFs. The conclusions in the RTI Report apply to both low-pressure fluorescent lamps and high intensity discharge lamps. The RTI Report concludes, among other things, that: (1) "Most mercury entering [MSW] landfills is retained within the waste and that the amount of mercury released from the MSW waste stream via leachate is insignificant." Id. at 101. (2) "Mercury is present at low concentrations in MSW landfill leachate, with a mean concentration of 0.0008 mg/L and a maximum measured value of 0.0098 mg/L." Id. at 112-13. These numbers are far below the TC, regulatory level for mercury of 0.2 mg/L. See also 59 Fed. Reg. at 38291. (3) "Considering the very low concentrations of mercury measured in [MSW] landfill leachate and the ability of soils and aquifer materials to retain at least some amount of mercury, it is reasonable to conclude that the impacts of

mercury in MSW landfill leachates on groundwater quality is negligible." RTI Report at 104 (emphasis added). See also 59 Fed. Reg. at 38291 ("EPA has identified studies that indicate that municipal solid waste has a significant capacity for retaining mercury in the landfill unless there are unusually large quantities of mercury in municipal solid waste"). (4) "In conclusion, significant impacts to groundwater quality from mercury in leachate from MSW appear to be extremely rare... Considering that mercury-containing lamps and batteries have been part of MSW stream for many years, and that all landfills in the U.S. have their share of these wastes, it can be concluded that mercury in such wastes is not readily released by the leaching processes that occur in the MSW landfill environment. This conclusion is further supported by controlled leaching studies of mercury-containing wastes codisposed with MSW." RTI Report at 111 (emphasis added). (5)"Extracts and leachates from MSW ash also show low mercury levels."Id. at 113. (6)"There is little, if any, evidence of adverse impacts of mercury in MSW on ground-water rescue" and "no significant human exposure to mercury is likely to result from MSW landfill leachate contamination of groundwater." Id. at 101, 166 (emphasis added). The findings of the RTI Report are compelling and unambiguous: the management of mercury-containing lamps in MSWLFs does not present a significant risk to human health and the environment. The RTI Report provides the most comprehensive and detailed review of this subject in the record and its conclusions cannot be dismissed by the Agency. The RTI Report's findings are confirmed by findings in the record regarding the management of mercury-containing lamps in MSWLFs, including a study measuring mercury deposition (in landfill gas and leachate) in four Swiss landfills. That study found approximately 0.007 percent of the mercury from the landfill in the leachate. 59 Fed. Reg. at 38291. The findings in this study are reinforced by other EPA studies involving Superfund Records of Decision ("RODs") at MSWLFs where mercury was identified as a "contaminant of concern." Id. Here again, the Agency found only minimal groundwater impacts attributable to mercury, with none of the mercury groundwater concentrations at these sites exceeding the mercury maximum contaminant level ("MCL") of 0.002 mg/L, let alone the TC regulatory level of 0.2 mg/L. Id. compounding evidence has led EPA to correctly conclude that

"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." Id.

2. Air Emission Impacts Do Not Warrant Regulating Mercury-Containing Lamps as Hazardous Waste The Agency has also sought comment on the potential for contamination of soil and surface water due to the volatilization of mercury during the transportation and crushing of mercury-containing bulbs and the release of mercury in landfill gas. 59 Fed. Reg. at 38292-93. Here again, however, the record evidence demonstrates that these scenarios do not result in the release of mercury to the environment that poses a threat to human health and the environment warranting regulation of mercury-containing lamps as hazardous wastes. A. The Evidence In The Record Demonstrates that Landfill Emissions from Mercury-Containing Lamps Do Not Pose a Threat to Human Health and the Environment The record demonstrates that mercury landfill gas emissions attributable to the disposal of mercury-containing bulbs are exceedingly small and, in fact, barely measurable over background. Id. at 38292. Based on the results of a Swiss study of landfill gas from municipal waste landfills, which EPA found were comparable to U.S. MSWLFs, the record demonstrates that the amount of mercury annually released in landfill gas can be estimated as (0.8 kg, about 0.0001 percent of the total mercury load entering MSW landfills (643 Mg)." Id. Taking this amount and adjusting it "to the proportion of total mercury contributed by mercury-containing lamps to the MSW streams (3.8 percent), provides an estimate of annual landfill gas emissions from lamps of about 0.03 kg, less than 0.00001 of the total municipal solid waste mercury input." Id (emphasis added) As EPA correctly reasons, this amount is in fact less than 0.001 percent, "when compared to the 3 Mg of mercury from lamps that is estimated to be emitted into the atmosphere through municipal waste combustors." Id. RTI also reviewed the literature on landfill emissions, in particular a Finnish study which found, based on an assessment of landfill gas that accepted municipal refuse, including mercury from batteries, fluorescent lamps, and broken thermometers, that "mercury concentrations in the air around landfills is slightly higher than rural areas, but at the same

> level as other city areas and that the refuse dump does not seem to increase the metal concentrations in air to levels above normal urban values." RTI Report at 112. Based on the above findings, the RTI Report concludes that contaminations in landfill gases appear to have little or no impact on air quality around a landfill." id. at 113 (emphasis added).
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> In short, EPA's re-examination in this rulemaking of the behavior of mercury from the management of mercury-containing lamps in MSWLFs has revealed new and more accurate data regarding the behavior of this particular constituent in the MSWLF environment. Having re-opened the record regarding the regulatory status of mercury- containing lamps, EPA cannot ignore this record evidence, which completely refutes the earlier assumptions incorporated into the TCLP and associated TC regulatory level for mercury. [3] [Footnote 3: EPA itself concedes that the existing regulatory levels for mercury under the TC regulation may overestimate the leaching potential of mercury and that, consequently, 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's studies 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. 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. Id.] These new data make clear that there is no "rational relationship" between the assumptions underlying the TCLP and the actual environmental impacts associated with the management of mercury-containing lamps in MSWLFs.

RESPONSE

The Agency agrees with the commenter regarding the continued reduction in the total amount of mercury used in the manufacturing of lamps. However, while the total mercury in lamps may be reduced over time, the total amount of mercury available to the environment may increase as more relamping occurs. EPA believes that disposal of hazardous waste lamps in Subtitle D landfills represents a concern due to the potential for releases of mercury (and other

hazardous constituents) to the environment during storage, transport, and disposal. The Agency believes that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators).

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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters: 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 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^{th} percentile compared with 85^{th} 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.

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).

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) (AEdison@). 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 that this is clearly a reaonable 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 plus 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 they are crushed after disposal in landfill cells; 2) mercury is in a leachate and water-soluble form in lamps; and 3) monitoring data from MSWLs confirm that mercury has escaped from the landfill unit, 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. Further information on environmental fate and transport, discussed above, confirm the possibility of mobilized mercury being released from MSWs to contaminate groundwater and to reach human or other receptors in potentially harmful concentrations. 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).

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. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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.

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 90th 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.

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 the 1992 analysis. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

While the Baccini et.al. (1987) study (cited by the commenter) appears to be fairly well conducted and partially relevant to the question of mercury leaching from landfills, it is not definitive on this issue, particularly in light of more recent data. Baccini et.al. measured contaminant concentrations in landfill leachate, and also in landfill gas, from four Swiss landfill units, along with the volume of released landfill leachate and gas. From these data, they calculated the flux, or rate of contaminant release (expressed in nanograms mercury per kilogram of waste per year) from the landfills for several constituents, including mercury. The mercury leachate concentrations measured and flux calculated were relatively low concentrations for mercury. The landfill leachate concentrations ranged from 0.02 to 2.4 micrograms per liter. This concentration range is at least two orders of magnitude lower than the TC regulatory level of 0.2 mg per liter measured using the TCLP test. Commenters appear to cite these data as providing useful insights into mercury behavior in landfills taking these values at face value, and without critically assessing their relevance to MSW landfill conditions and regulations in the United States.

There are two important differences between the Swiss landfills and U.S. MSW landfills that limit the relevance of this study. First, the estimated mercury concentration in the MSW is approximately half that of the US MSW (2 ppm) (Baccini Table 2), compared to 3.6 ppm in the US; see RTI report, p.77). Second, and much more significantly, the Swiss landfill leachate collection system is covered by two to four meters of dense clay, and collects the leachate only after it passes through this clay liner. The ability of this liner to reduce the volume of leachate passing through the landfill, and the concentration of waste contaminants in the leachate are both significant. Liners of this type are not required in Subtitle D waste management units, and the TCLP/TC regulation reflects this fact. The fact of this substantial liner in the Swiss landfills significantly reduces the relevance of the study to U.S. conditions. When viewed in light of data found in CERCLA RODs, the characteristic Scoping Study, and recent preliminary landfill leachate data, Baccini et.al. is quantitatively irrelevant to assessing mercury risks in U.S. MSW and other landfills.

DCN FLEP-00191
COMMENTER Utility Solid Waste Activities Group
SUBJECT FATE
COMMENT The record demonstrates that one of the largest manmade sources of mercury loadings into the environment is from combustion

point sources. [9] [Footnote 9: See EPA Office of Air Quality Planning and Standards, National Emission Inventory of Mercury Compounds: Interim Final Report at ES-6 (Dec. 1993), Docket No. FLEP-S0026 (the "EPA Emissions Report").]

RESPONSE

The Agency agrees with the commenter that one of the largest sources of mercury releases to the environment is represented by combustion sources. In order to address this concern, under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. As a result of this requirement, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). The Mercury Emissions Report (Table 3-2) shows lower emissions from lamp management for all the universal waste options than either the current practice (baseline) or the conditional exclusion.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00196
COMMENTER American Lighting Association
SUBJECT FATE
COMMENT EPA studies have clearly demonstrated that landfilling of mercury-containing lamps presents little risk to human health or the environment. Mercury has been shown not to leach or otherwise escape from municipal landfills, and indeed, the quantity of lamps assumed to be disposed in landfills each year

(250 million pounds) is insignificant in comparison to the 1 million tons of household hazardous waste and the 160 million tons of municipal waste landfilled each year.

RESPONSE

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

The Agency believes that management 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

DCN FLEP-00197
COMMENTER Cincinnati Gas and Electric Company
SUBJECT FATE
COMMENT The proposed exclusion for mercury-containing lamps is grounded on a compelling technical record, as supplemented by USWAG and EPRI in their separate comments, that mercury- containing lamps do not warrant regulation as hazardous wastes when managed in qualified municipal solid waste landfills. In EPA's "Management Of Used Fluorescent Lamps: Preliminary Risk Assessment," the

data demonstrates that mercury does not leach from MSWLFs at levels that pose a threat to human health and the environment, and that mercury emissions from landfill gas are "very small."

RESPONSE

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

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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-containing lamps under several regulatory approaches. The Agency believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

DCN FLEP-00199
COMMENTER National Association of Electric Dist.
SUBJECT FATE
COMMENT Position on Subtitle D Landfilling. We are comfortable with a

regulatory approach that allows landfilling of spent lamps in state- permitted municipal landfills that meet Subtitle D standards for new landfill units. EPA studies have clearly demonstrated that landfilling of mercury-containing lamps presents little risk to human health or the environment. Mercury has been shown not to leach or otherwise escape from municipal landfills, and indeed, the quantity of lamps assumed to be disposed in landfills each year (250 million pounds) is insignificant in comparison to the 1 million tons of household hazardous waste and the 160 million tons of municipal waste landfilled each year. Air emissions due to breakage can be controlled through proper handling and packaging practices, and, as indicated earlier, the regulatory provisions should address crushing of lamps. A sunset provision requiring EPA to review the effectiveness of the tailored standards, however, would be appropriate.

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. 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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-containing lamps under several regulatory approaches.

The Agency believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

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. 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 current universal waste rule also prohibits universal waste handlers from treating universal wastes (40 CFR '273.11 and 273.31). The crushing of hazardous waste lamps falls within the definition of treatment under RCRA (40 CFR 260.10).

The Agency is not including a sunset provision with today=s final rule. The Agency believes that the data and information provided to the Agency and the Agency=s own studies and analyses that were conducted during the period of time since the hazardous waste lamps rulemaking was proposed provide adequate evidence of the behavior of mercury in the environment and the potential releases of mercury to the environment to support today=s final rule. The Agency notes, however, that should sufficient and compelling information related to the behavior of mercury become available in the future, the Agency can always re-evaluate the standards promulgated in today=s final rule.

DCN FLEP-00204
COMMENTER American Lamp Recycling, Ltd.
SUBJECT FATE
COMMENT Second, the Agency's determination that 20 metric tons per year of mercury is the maximum landfill contribution from

mercury-containing lamps is in error as this figure was apparently derived by using only the fluorescent lamp subset of the mercury- containing lamp universe. What is the potential contribution from all mercury-containing lamps making up the 3.9 billion lamps the Agency believes are disposed of annually?

RESPONSE

Today's final rule adds all hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. For reasons explained in the preamble and elsewhere in this response to comments document, the Agency has decided that hazardous waste lamps present enough risk to human health and the environment to warrant regulation. 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 is less stringent than full Subtitle C management standards).

DCN SCSP-00205
COMMENTER Florida Dept. of Environ. Regulation
SUBJECT FATE
COMMENT The above wastes are generated by a large number of sources in the household, industrial, commercial and governmental sectors which do not ordinarily generate hazardous waste (Florida disposes of an estimated 30 million fluorescent bulbs each year). They would pose a low level of risk during storage and transport to a consolidation point or destination facility. They do pose a risk of mercury contamination to the environment if they are disposed in municipal waste combustors or in landfills (e.g. broken mercury lamps and thermometers on a truck or at the landfill surface face during a hot day). In addition, some mercury amalgam is being red-bagged and going to biohazardous waste incinerators which are probable emitters of mercury to the air.

RESPONSE

The Agency recognizes that hazardous waste lamps are generated by many facilities which are not familiar with or equipped to comply with the full Subtitle C regulatory structure. This structure was initially developed with industrial hazardous wastes in mind, and is most appropriate for these materials and for the types of facilities that generate these wastes. The streamlined universal waste structure is more appropriate for the numerous, widely varied universe of lamp handlers who are not familiar with or easily able to comply with the full hazardous waste regulatory structure. Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment,

storage, and disposal facilities. As a result of this requirement, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks).

DCN SCSP-00211
COMMENTER Minnesota Pollution Control Agency
SUBJECT FATE
COMMENT The April 1992 EPA study entitled, "Characterization of Products Containing Mercury in Municipal Solid Waste in the United States, 1970 to 2000" documents the significant quantities of mercury from mercury-bearing waste products ending up in the nation's solid waste stream. As pointed out in the study, the study did not include quantities of mercury from mercury-bearing waste products generated by RCRA generators. Based on review of hazardous waste manifests, MPCA staff believes that, with few exceptions, RCRA generators also dispose of these mercury-bearing waste products in the solid waste stream, thus significantly increasing the quantities documented in the study. Mercury-bearing waste products are major contributors of mercury emissions from solid waste incinerators and landfills.
RESPONSE

The Agency recognizes that hazardous waste lamps are generated by many facilities which are not familiar with or equipped to comply with the full Subtitle C regulatory structure. This structure was initially developed with industrial hazardous wastes in mind, and is most appropriate for these materials and for the types of facilities that generate these wastes. The streamlined universal waste structure is more appropriate for the numerous, widely varied universe of lamp handlers who are not familiar with or easily able to comply with the full hazardous waste regulatory structure. Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. As a result of this requirement, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks).

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other

sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00215
COMMENTER Sterling Chemicals, Inc.
SUBJECT FATE
COMMENT Moreover, EPA's own scientific evidence supports a conclusion that Subtitle C management of these lamps is not necessary. 59 Fed. Reg. 38,288, 38,291-93 (July 27, 1994). A properly designed Subtitle D facility, that is operated in compliance with a state's municipal solid waste (MSW) landfill criteria and requirements, provides ample protection of human health and the environment. EPA's data indicate that less than 0.01 percent of the mercury in MSW landfills leaches from the landfill.
RESPONSE

The Agency believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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 Hatters" 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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-containing lamps under several regulatory approaches.

Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. As a result of this requirement, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks).

DCN FLEP-00218
COMMENTER Louisiana Dept. of Environmental Quality
SUBJECT FATE
COMMENT 5. Arguments that mercury emissions from used lamps are too small to regulate should be tempered by the knowledge that these emissions are certain to increase. By EPA's own estimation, mercury discards from used lamps are growing dramatically, both in absolute terms and as a percentage of total mercury discarded. Used lamps represent the only mercury-bearing constituent of the municipal waste stream which is projected to increase. (USEPA 1991, "Characterization of Products Containing Mercury in Municipal Solid Waste in the United States" OSW) 6. EPA has yet to conduct a satisfactory study of mercury vapors in

> landfill vents. Even if present estimates are reliable, they may eventually become irrelevant, because the physical and chemical character of municipal landfills will soon change in unpredictable ways. EPA plans to initiate some of these changes, mainly through application of solid waste regulations and recycling initiatives. One change that can be predicted is that the chemical identity of the landfilled mercury will slowly shift to more water-soluble forms. We also face the certainty that long after the chlor-alkali industry and other major sources of airborne mercury have abated, landfilled mercury will continue to partition to atmosphere and groundwater.

RESPONSE

The Agency agrees with the commenter that disposing of hazardous waste lamps in Subtitle D landfills is not the most desirable option, in part because the Agency does not have data characterizing the behavior of mercury in different types of landfills over the long term. EPA also agrees with the commenter that MSWL disposal under the conditional exclusion option could increase the volume of mercury that is land disposed. Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The effect of this rule should be to increase the source reduction of mercury in lamps, as well as reducing the volume of lamps going to landfills. 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 has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

The discussion of mercury fate and transformation in the environment presented in the *Mercury Report to Congress* (vol. 3, chapter 2) illustrates the many forms of mercury in the environment, and mercury=s propensity to interconvert among these forms. More significantly for landfills, CERCLA RODs and the Agency=s 1996 Hazardous Waste Characteristics Scoping Study show clear potential for further mercury contamination of wells near municipal solid waste and other landfills.

DCN FLEP-00222
COMMENTER Columbus Southern Power & OH Power Co.
SUBJECT FATE
COMMENT EXEMPTION OF MERCURY-CONTAINING LIGHTING WASTE FROM SUBTITLE C REGULATION

> CSP/OPCo believes that an exemption of mercury-containing lamps is protective of the environment. When managed in qualified municipal solid waste landfills. U.S. EPA's own data demonstrate that mercury does not leach from these landfills at levels that pose a threat to human health and the environment and that mercury emissions from landfill gas are "very small". See "Management of Used Fluorescent Lamps: Preliminary Risk Assessment," (May 14, 1993) RTI Project No. 94U-5400-010.

RESPONSE

The Agency believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA

program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. As a result of this requirement, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks).

DCN FLEP-00224
COMMENTER Amtech Lighting Services
SUBJECT FATE
COMMENT Although it is a fact that US lamps contain less than 2% of the total mercury in our environment, the amount of mercury that is potentially released through handling lamps is dwarfed by the emissions of mercury from combustion sources. (Estimated to be over 286 tons per year.)
RESPONSE
The Agency believes that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). Although most mercury emissions are associated with combustion, all releases contribute to the mercury reservoirs in land, water and air. As noted in other comments, groundwater (and drinking water) contamination with mercury from MSW leachate has occurred at numerous CERCLA sites, and so this exposure pathway is of

cncern, notwithstanding that the potential amount of mercury released is less than through combustion. 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00226
COMMENTER FMS Lighting Management Systems, Inc.
SUBJECT FATE
COMMENT 1. The amount of mercury from fluorescent and HID lamps is less
than .2% of the total mercury in the environment and accounts
for only 3.8% of the total mercury in municipal solid waste.
When you compare the amount of mercury emission from combustion
sources, which is far greater, to mercury from fluorescent and
HID lamp. It appears that the problem is with mercury emission
not with mercury from fluorescent & HID lamps.
RESPONSE

The Agency agrees with the commenter that one of the largest sources of mercury releases to the environment is represented by non-hazardous waste incinerators. However, EPA does not agree that hazardous waste lamps do not warrant regulation under RCRA. The Agency believes

that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. Therefore, as a result of the universal waste requirements, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks).

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

As explained more fully in other responses, lamps comprise the second largest source of

mercury to MSWLs (albeit smaller by far than batteries, the largest source; however, batteries contain a casing but lamps will release mercury upon crushing). The amount of mercury in MSWLs, estimated at 24 Mg annually, is substantial.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

DCN FLEP-00228
COMMENTER STAPPA/ALAPCO
SUBJECT FATE
COMMENT Data on Mercury Emissions The proposal of a conditional exemption under RCRA is based upon the assumption that very little mercury escapes from landfills. However, there is limited data to support this conclusion. It is true that the data show that relatively little mercury escapes from municipal landfills via the ground water or air after disposal is complete. However, none of these studies accounts for the escape of mercury into the air during collection and initial disposal. Typical solid waste management practices involve compacting solid waste before covering the material. It is very likely that lamps are broken during compaction or even during transport prior to arriving at the landfill. When lamps break, the mercury inside is available for volatilization, adsorption or reaction. An EPA study shows significantly lower mercury emissions caused by the breakage of fluorescent lamps during transport for recycling, than for transport during garbage disposal (Draft Management of Used Fluorescent Lamps: Preliminary Risk Assessment, Final Report Research Triangle Institute, October 1992, at 159-160.)
RESPONSE

The Agency agrees with the commenter that the potential for mercury releases to the

environment is greater when hazardous waste lamps are landfilled than when they are recycled. Today=s final rule is expected to increase the amount of hazardous waste lamps that are recycled. Under today=s rule, which adds hazardous waste lamps to the Universal Waste regulations in 40 CFR Part 273, generators have several options with regard to waste management, but the ability to access large quantities of universal waste from central collection centers may encourage the development of safe and effective methods to recycle universal waste. In addition, as the demand for lamp recycling grows, recycling could become more cost competitive with Subtitle C landfilling. The EPA believes that increased recycling capacity and continued improvements in technologies may lower recycling fees.

The mercury lamp management air emissions study estimated the air releases from all aspects of lamp management for current management practices, and the regulatory options considered in the proposal. Table 3-2 indicates that all of the universal waste options considered would result in a net reduction of mercury emissions from lamp management, when compared with either current management (baseline analysis) or the conditional exclusion option.

DCN FLEP-00229
COMMENTER Global Recycling Technologies, Inc.
SUBJECT FATE
COMMENT 5. NEMA targeted source reduction for mercury in lamps of 27.0 mg by 1995 will impact discards approximately in the year 2000. Increasing usage of mercury-containing lamps will offset source reduction. The average mercury content of lamps currently discarded is 41.6 mg. 6. If lamps are excluded, other electrical mercury containing devices could also be considered to be treated the same. Electro-mechanical thermostats and mercury light switches account for another 14 tons of mercury discarded per year. This would bring the "excluded" mercury discards total to 48 tons/year, representing 31 % of mercury discards in the municipal waste stream.
RESPONSE

The Agency agrees with the commenter=s concerns regarding the conditional exclusion option and, in today=s rule, 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 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 has determined that hazardous waste lamps meet the criteria established for designating a material as universal waste. The universal waste rule ensures that mercury emissions are minimized during all stages of lamp management (see Table 3-2 of the emissions study). 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. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities.

DCN FLEP-00229
COMMENTER Global Recycling Technologies, Inc.
SUBJECT FATE
COMMENT 8. Approximately 600 million lamps a year (and growing) are disposed of in the US annually, accounting for some 34 tons of mercury into the unregulated waste stream (projected to 41 tons by the year 2000), and the environment. 9.Total mercury released to the atmosphere from mercury- containing lamps in the US is significant (from 294,000,000 mg 1,650,000,000 mg per year or greater. This signifies a need for consistent management policy for mercury reduction in the US, or individual states efforts will be for naught.

OTHER "UNIVERSAL" WASTES Additionally, thermostats and mercury light switches contribute an additional 14 tons [7] [Footnote 7: "Characterization of Products Containing Mercury in Municipal Solid Waste in the United States", 1970 - 2000, April 1992, U.S. EPA OSW Municipal and Industrial Solid Waste Division.] of mercury to the municipal solid waste stream. If the "Conditional Exclusion" position is adopted for mercury- containing lamps then this would naturally open the door for thermostats and mercury light switches to be treated in a like manner. These electrical products would, combined with mercury lamps, be allowed to continue to contribute over 48 tons of mercury annually to the environment in the U.S.

Excerpts from the Federal Register: Pg. 7; "EPA's preliminary analysis indicates 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..... However, these studies are still ongoing (U.S. EPA, 1991b)." Pg. 7; a relatively high percentage of these lamps, when spent, exhibit the characteristic of toxicity. (U.S. EPA, 1992a) Pg. 13; "..on May 8, 1994, generators of mercury-containing lamps will be required (under the Land Disposal Restrictions) to meet a treatment

standard for lamps as hazardous debris." Pg. 19, "The behavior of mercury in a MSW landfill is not known in great detail. The complexity of aqueous mercury chemistry makes it difficult to predict and model at this time Pg. 229..... there are concerns over emissions of mercury from lamps from municipal waste combustors, possibly landfill gas, as well as concerns with the handling and disposal of mercury lamps." Pg. 27, "Based on available information, it was assumed for the purposes of this model that as much as 6.6% of mercury could be released in the air from a lamp broken during the collection, storage and transport of mercury-containing lamps in garbage trucks." Pg. 28, "...information suggests that given the high vapor pressure of mercury, it can readily volatilize to the air and be transported, perhaps long distances, and be deposited on surface water or soil (which can run off into surface water). Some mercury that is subsequently methylated will bioaccumulate in the food chain." Pg. 29, ..."because mercury is such a volatile metal, amounts of mercury could be released into the air from lamps broken at the landfill." Excerpts f rom the RTI Report: Section 1, page 17; Unlike all other metals, mercury is liquid at room temperature and has a significant vapor pressure. Thus, metallic mercury can move in the subsurface and can volatilize from the soil environmental Section 1 , page 22; "Mercury is unique among trace metals in that it readily moves back and forth between liquid, solid, aqueous, and gaseous species." "....there are two potential effects of mercury's volatility that should be considered with respect to mercury in the subsurface: volatilization from unsaturated soil contaminated with mercury, and mercury input to subsurface systems from precipitation wash-out of volatile mercury and aquifer recharge." and..... the fate and transport of mercury in the subsurface is intended to demonstrate the extreme complexity of its subsurface chemistry." Section 5.2.1.3, page 97; "Transformations of mercury in a landfill are not known in great detail. This fact and the complexity of aqueous mercury chemistry makes them difficult to predict and impossible to model at this time."

RESPONSE

The Agency agrees with the commenter=s concerns regarding the conditional exclusion option and the potential for mercury releases to the environment associated with some mercury management practices, in particular disposal through the municipal solid waste stream. EPA recognizes that the

Agency does not have data characterizing the behavior of mercury in different types of landfills over the long term. However, data from CERCLA RODs (which can reflect situations where wastes were stored for substantial periods), the 1996 Hazardous Waste Characteristics Scoping Study, and preliminary landfill leachate data collected by the Agency clearly shows that mercury can leach from landfills and contaminate drinking water wells at concentrations exceeding the MCL.

In today=s rule, the EPA 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 universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00232
COMMENTER Houston Lighting and Power Company
SUBJECT FATE
COMMENT EPA studies have also shown that disposing of spent fluorescent lamps in MSWLFs would not significantly impact ground-water quality from leaching mercury and that the human exposure to mercury gas emitted from crushed fluorescent lamps are several

orders of magnitude in concentration below the OSHA permissible exposure limit for airborne mercury. In light of this compelling record of evidence, EPA is fully justified in moving forward and adopting the conditional exclusion for mercury-containing lighting wastes.

RESPONSE

In today=s rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Instead, 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 is less stringent than full Subtitle C management standards).

The Agency believes that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be

transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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

wells in future years.

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-containing lamps under several regulatory approaches.

DCN FLEP-00234
COMMENTER Minnesota Mining and Manufacturing (3M)
SUBJECT FATE
COMMENT Spent lamps account for a fraction of the total mercury potentially released into the environment. EPA should focus their efforts on reducing mercury emissions from other sources such as a combustion processes rather than unnecessarily regulating a minor emission source such as fluorescent lamps.
RESPONSE

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. 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 believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 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-containing lamps under several regulatory approaches.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00239
COMMENTER National Sign Association
SUBJECT FATE
COMMENT The key issue is whether the risk of mercury discharge from landfilled waste lamps into the groundwater and air is so severe that it merits regulation under RCRA Subtitle C. EPA has stated in the Preamble to its proposal that lamps account for only 3.8% of the total mercury found in MSW landfills. 59 Fed. Reg. 38288, 38291 (July 27, 1994). The Preamble also states that "less than. 0.01% of the mercury in MSW landfills leaches from the landfill." Id. Thus, mercury does not seem to be leached from MSW landfills at any significant levels. Furthermore, the quantity of mercury potentially released from landfilled lamps from all sources (both interior fluorescent lamps and sign lamps) is dwarfed by the emissions of mercury from incineration. (0.03 kg/year v. 98 metric tons/year. 59 Fed. Reg. at 38292). In fact, mercury gas emissions from landfilled lamps is less than one thousandth of one percent the mercury gas emissions from incinerated lamps (0.00003 metric ton/year lo 3 metric tons/year). 59 Fed. Reg. at 38292.
RESPONSE

Today's final rule does not regulate hazardous waste lamps under the full Subtitle C management standards but instead adds hazardous waste lamps to the universal waste regulations 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 believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment

posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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-containing lamps under several regulatory approaches.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*,

167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00243
COMMENTER Recycling Advocates of Middle Tennessee
SUBJECT FATE
COMMENT The EPA acknowledges the possibility that disposal practices for mercury-containing wastes are at least partly responsible for the huge number of fish consumption bans/advisories (over 1,550 in the U.S.), many in isolated, pristine lakes. Other possibilities are not described. Are there any? The only one mentioned by EPA is coal-burning. If wood-burning is ever considered, it should be noted that levels in wood are presumably at elevated levels due to uptake from disposal-contaminated soils. Regarding Hg releases from landfills and ashfills, the EPA's explanatory material totally ignored many pathways, including ingestion by soil worms, uptake by fungi, dust blowing, etc. Such deposits may be disturbed at some point in the future beyond present-day monitoring periods. These types of omissions in the analysis are inexcusable.
RESPONSE

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-containing lamps under several regulatory approaches. 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. EPA remains concerned that landfill releases may pose threats over the long term. Data from CERCLA RODs and other sources support this concern. Studies also show that mercury releases from the management of lamps during storage and transport is significant. Uncontrolled breaking of lamps allows mercury to be emitted into the air.

For these reasons, EPA is not promulgating a conditional exclusion for hazardous waste lamps. Today=s final rule adds hazardous waste lamps to the scope of the universal waste rule of 40 CFR Part 273. 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. Ultimately, though, the hazardous waste lamps must be managed at a hazardous waste treatment, storage or disposal facility or recycled.

DCN FLEP-00259
COMMENTER Cherry City Electric, Inc.
SUBJECT FATE
COMMENT The estimated mercury emissions alone from nationwide combustion sources is 286 tons into our atmosphere. Landfilling lamp emissions is estimated to be a mere .04 to .31 tons annually. The logic is obvious to me.
RESPONSE

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-containing lamps under several regulatory approaches. 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. EPA remains concerned that landfill releases may pose threats over the long term. Data from CERCLA RODs and other sources support this concern. Studies also show that mercury releases from the management of lamps during storage and transport is significant. Uncontrolled breaking of lamps allows mercury to be emitted into the air. 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.

Because today=s final rule requires that destination facilities (i.e., facilities that treat, dispose, or recycle universal waste) that manage universal waste lamps must comply with all applicable requirements of Subtitle C, today=s rule may greatly reduce the amount of hazardous waste-containing lamps that are managed in municipal solid waste combustors, therefore resulting in significant reductions in potential mercury emissions from these sources.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR

33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00262
COMMENTER OG&E Electric Services
SUBJECT FATE
COMMENT OG&E is encouraged by the Agency's recognition that, based on available data, the impact of mercury released from mercury-containing lamps does not appear to pose a substantial present or future threat to human health or the environment and that, at a minimum, the lamps themselves do not warrant full regulation under Subtitle C.
RESPONSE

Today's final rule adds hazardous waste lamps to the universal waste regulations 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 believes that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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. Consumption of mercury contaminated fish or shellfish can also represent a significant exposure source for humans.

Data from CERCLA RODs, the 1996 Hazardous Waste Characteristics Scoping Study and other sources show that mercury can be found in municipal landfill leachate and ground water wells, and EPA remains concerned that landfill releases may pose threats over the long term. The Agency has concluded that some 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 from the management of hazardous waste-containing lamps under several regulatory approaches.

DCN FLEP-00281
COMMENTER Michigan Dept. of Natural Resources
SUBJECT FATE
COMMENT The last sentence in paragraph 3 of page 2 of the draft letter indicates that mercury containing lamps are a significant source of atmospheric mercury and that this source is expected to grow. Page 3, paragraphs 1 and 2 seem to contradict this by indicating that little mercury is released to air or ground water after disposal. Further, none of U.S. EPA's studies account for the loss of mercury during collection and disposal. Altogether, these statements seem to be confusing and somewhat contradictory.
RESPONSE

Since publication of the proposed rule, the Agency has 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-containing lamps under several regulatory approaches.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

Today=s final rule adds hazardous waste lamps to the scope of the universal waste rule. 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.

DCN FLEP-00289

COMMENTER Fluorescent Maintenance Company
SUBJECT FATE
COMMENT Given the data on Mercury contamination from spent fluorescent and HID lamps: that EPA studies show that mercury does not leach in significant amount from municipal landfills, that US lamps contain less than .2% of total mercury in the environment, that US lamps account for only 3.8% of total mercury in municipal waste, that the quantity of mercury potentially released from landfilling of lamps (.04 to .31 tons) is insignificant compared to the quantity of mercury released in the burning of fossil fuel to generate electricity. Given this data, we believe it a foolish mistake to designate fluorescent and HID lamps as Subtitle C hazardous waste or include them under the Universal waste rule.
RESPONSE

The Agency believes that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater, as suggested in the proposal, and concluded that disposal in MSWs does indeed pose the potential for substantial harm (even though air emissions from combustion sources accounts for more release of mercury into the ambient environment).. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a

half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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-containing lamps under several regulatory approaches.

Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. As a result of this requirement, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks).

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00295
COMMENTER Texas Instruments, Inc.
SUBJECT FATE
COMMENT TI further believes that the overwhelming number of mercury releases to the environment are from combustion sources and not from current Subtitle D disposal practices.
RESPONSE

The Agency believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

While most mercury may be released to the environment from combustion, data from CERCLA RODs and the 1996 Hazardous Waste Characteristics Scoping Study on leaching and ground water contamination show that mercury from landfills can contaminate drinking water wells.

DCN FLEP-00296
COMMENTER State of Ohio EPA
SUBJECT FATE
COMMENT Transport data - In view of the limited data on fate and

transport of mercury, the U.S. EPA should consider conducting a pilot study on fate and transport modeling of mercury in the environment.

RESPONSE

Since publication of the proposed rule, the Agency has collected additional data on the fate of mercury in the environment. 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-containing lamps under several regulatory approaches. Studies also show that the greatest mercury releases directly attributable to the management of lamps is during storage and transport. Uncontrolled crushing and breaking of lamps allows mercury to be emitted into the air.

Today=s final rule adds hazardous waste lamps to the scope of the universal waste rule. 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.

DCN FLEP-00300
COMMENTER ElectricSave Company
SUBJECT FATE
COMMENT In fact, US lamps contain less than .2% of total mercury in the environment and account for only 3.8% of total mercury in municipal solid waste. The quantity of mercury potentially released from landfilling of lamps (.04 to .31 tons) is dwarfed by the emission of mercury from combustion sources, estimated to be 286 tons per year. Clearly EPA resources are better spent addressing mercury emissions from combustion than in unnecessarily regulating a minor mercury source such as fluorescent lamps.

RESPONSE

The Agency believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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 Hatters" 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.

Therefore today's rule adds hazardous waste lamps to the universal waste rule under 40 CFR Part 273. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. As a result of this requirement, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks).

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

While most mercury may be released to the environment from combustion, data from CERCLA RODs and the 1996 Hazardous Waste Characteristics Scoping Study on leaching and ground water contamination show that mercury from landfills can contaminate drinking water wells.

DCN FLEP-00301
COMMENTER Minnesota Pollution Control Agency/MOEA
SUBJECT FATE
COMMENT 3. Lack of Conclusive Supporting Data and Burden of Proof First, in the proposed rule EPA indicates repeatedly that there exists inconclusive data and more information is needed regarding many

mercury release pathways in the solid waste stream. For other pathways or certain types of solid waste facilities, EPA indicates that there is no available data. Some segments of the nation's complex solid waste management system (which would undoubtedly receive lamps, crushed/broken lamps, or residuals from treatment under the CE alternative) are not even accounted for under the proposal. These facilities include composting facilities, shredding/processing facilities, and wastewater treatment plants receiving landfill leachate. Yet, despite these data gaps, EPA offers a number of major conclusions slanted towards the CE alternative based on the inconclusive limited information available and other Conclusions based on pure assumptions (e.g., 6.6 percent of mercury released during lamp breakage).

B. Level of Mercury Contamination. Several studies have concluded that mercury levels in the environment have more than tripled since the Industrial Revolution, [Note 9: Swain, E.B., et. al. 1992. "Increasing Rates of Atmospheric Mercury Deposition in Midcontinental North America." Science 257:784-787. (Enclosure 7.) Note 10: "Mercury Atmospheric Processes: A Synthesis Report." Expert Panel on Mercury

(Enclosure 8.) (See hard copy of Comment FLEP-00301 for attachments.)] an extremely short period in Earth's life. Several studies indicate that mercury levels in the environment are increasing relatively rapidly at a rate of about 1.5 to 1.7 percent per year. [Note 10: "Mercury Atmospheric Processes: A Synthesis Report." Expert Panel on Mercury Atmospheric Processes. 1994. Prepared under Research Project 9050, Electric Power Research Institute. Report No. TR-104214. (Enclosure 8.) (See hard copy of Comment FLEP-00301 for attachments.)] C. Sources and Cycling of Mercury Contamination. The current scientific consensus is that one-half to three quarters of the mercury now cycling in the environment is due to anthropogenic uses and releases. [Note 10:"Mercury Atmospheric Processes: A Synthesis Report." Expert Panel on Mercury Atmospheric Processes. 1994. Prepared under Research Project 9050, Electric Power Research Institute. Report No. TR-104214. (Enclosure 8.) (See hard copy of Comment FLEP-00301 for attachments.)] The balance is emitted by naturally occurring sources (e.g.,

volcanoes, forest fires). It is estimated that up to half of anthropogenic releases are deposited within 1,200 miles of the emission source. [Note 10:"Mercury Atmospheric Processes: A Synthesis Report." Expert Panel on Mercury Atmospheric Processes. 1994. Prepared under Research Project 9050, Electric Power Research Institute. Report No. TR-104214. (Enclosure 8.) (See hard copy of Comment FLEP-00301 for attachments.)] The balance becomes part of the global pool of mercury. Mercury emitted to the atmosphere is probably deposited and re-emitted to the atmosphere several times before it is finally immobilized in the environment (both the oceans and terrestrial soils re-emit deposited mercury, sometimes called the "ping-pong effect"). Because of the continued cycling of mercury in the biosphere, slow releases from a landfill may not have significantly less environmental effect than instantaneous release. D. Sources of Anthropogenic Emissions. The U.S. sources of anthropogenic emissions most commonly mentioned are power plants, utilities, and industrial facilities that burn coal and other fossil fuels that contain mercury. However, one can combine all other sources to show that mercury-containing products as a category may rival the emissions from the burning of fossil fuels. The MPCA estimates that about 50 to 65 percent (3851 to 6937 lbs) of the annual anthropogenic mercury emissions (7636 w 10722 lbs.) in Minnesota are related to mercury-containing products, such as lamp, thermostats, switches, and thermometers. In other states, the emissions from mercury products will be higher or lower than Minnesota's depending on population and specific industry uses. In any case, mercury-containing products, as a source category, are responsible for a significant amount of mercury emissions across the nation .[Note 4: "Strategies for Reducing Mercury in Minnesota." MPCA Mercury Task Force. Minnesota Pollution Control Agency. St. Paul, Minnesota. 1994. (Enclosure 6.) (See hard copy of Comment FLEP-00301 for attachment.)]

10. Lamps are a Significant Source of Mercury Release and Contamination We believe that discarded lamps are a significant and avoidable source of mercury release into the environment. The fundamental debate in this proposal is between two contrasting perspectives on mercury. One perspective holds that mercury is a problem only if release concentrations exceed acute

health standards at the local level. The second perspective, while recognizing the importance of acute health standards, holds that even after dilution in the environment, bioaccumulation can and does reconcentrate mercury to toxic levels. Total mercury releases are as important as local release concentrations. It is significant that the mercury content of rainfall (about 20 nanograms per liter) exceeds the surface water standard (12 nanograms per liter) established by EPA that is designed to protect against bioaccumulation. [Note 14:U.S. EPA 1993a. Page 49.] It is this surface water standard that-bridges the two perspectives on mercury. A primary objective of our mercury control activities must be to maintain ambient concentrations at or below the levels at which bioaccumulation occurs. To do this, we must minimize total releases. In short, any mercury emissions are significant. Within this context, lamps represent a significant and expanding use of mercury that cannot be ignored or downplayed. The EPA proposal and its background documents contain data and estimates on mercury consumption and disposal that were made in 1990. [Note 3: "Characterization of Products Containing Mercury In Municipal Solid Waste in the United States, 1970 to 2000." EPA 530-R-92-013. U.S. EPA. Washington, D.C. April 1992. (U.S. EPA. 1991c.)] However, in terms of both percentage and quantity, mercury consumption patterns have changed dramatically since then. The most recent US consumption estimates are for 1992 and were published in March 1994. [Note 1:"Mercury." Engineering and Mining Journal. March 1994. Pages 21-22. (Enclosure 5.) (See hard copy of Comment FLEP-00301 for attachments.)] We have not been able to find published consumption estimates for 1993. EPA Should use the most current available data in developing the final rule. Lamps are now the second largest annual product use of mercury. Lamps have a known and relatively short lifetime compared to other products containing, mercury such as thermostats, switches, thermometers, manometers, and relays. On a tonnage basis, mercury use in lamps has increased over 50 percent between 1989 and 1992. [Note 1:"Mercury." Engineering and Mining Journal. March 1994. Pages 21-22. (Enclosure 5.); Note 2: "Management of Used Fluorescent Lamps: Preliminary Risk Assessment." U.S. EPA. Washington, D.C. May 1993. Page 87. (U.S. EPA 1993a.) (See hard copy of Comment FLEP-00301 for attachments.)] It is the only product category that is

projected to increase its mercury consumption in the future. Actual mercury use in lamps is far exceeding forecasts published only two years earlier. [Note 1:"Mercury." Engineering and Mining Journal. March 1994. Pages 21-22. (Enclosure 5.) (See hard copy of Comment FLEP-00301 for attachments.); Note 3:"Characterization of Products Containing Mercury In Municipal Solid Waste in the United States, 1970 to 2000." EPA 530-R-92-013. U.S. EPA. Washington, D.C. April 1992. (U.S. EPA. 1991c.)] As discussed previously, there are an enormous number of other mercury-containing products. The MPCA estimates that about 50 to 65 percent of the annual anthropogenic mercury emissions in Minnesota are related to mercury-containing products. In other states, the emissions from mercury products will be higher or lower than Minnesota's depending on population and specific industry uses. Therefore, mercury-containing products, as a source category, are responsible for a significant amount of mercury emissions across the nation. As the second largest emissions source within this source category, lamps represent a significant and expanding source of mercury that cannot be ignored or downplayed given the need to reduce total mercury releases.

RESPONSE

The Agency thanks the commenter for the information and additional data on mercury releases and its behavior in the environment. EPA has decided to add hazardous waste lamps to the universal waste regulations under 40 CFR Part 273 (in part due to some of the reasons discussed by the commenter). 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 is less stringent than full Subtitle C management standards).

The universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

The universal waste rule ensures that mercury emissions are minimized during all stages of lamp management. 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 also 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 storage facilities, although the Agency does not regulate the actual process of reclaiming mercury. In addition, recycling facilities (as well as Adownstream@ 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).

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.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

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 are likely to decrease.

DCN FLEP-00301

COMMENTER Minnesota Pollution Control Agency/MOEA
SUBJECT FATE
COMMENT 1. Why must total mercury emissions be controlled? The fundamental debate here is between two contrasting perspectives on mercury. One perspective is exclusively from the local point of view; mercury is a problem only if release concentrations exceed acute health standards. The second perspective, while recognizing the importance of acute health standards, holds that even after dilution in the environment, bioaccumulation can and does reconcentrate mercury to toxic levels. Mercury bioaccumulation occurs because of a unique combination of these properties. Mercury is an element, it is volatile at ambient temperature, and it readily moves between organic and inorganic states. Hence, total mercury releases are just as important as local release concentrations. It is significant that the mercury content of rainfall (about 20 nanograms per liter) exceeds the surface water standard (12 nanograms per liter) established by EPA that is designed to protect against bioaccumulation.
RESPONSE

The Agency recognizes the fact that mercury can bioaccumulate in the environment and pose a threat to human health and the environment. Although EPA does not have the authority in this rulemaking to address all of the issues that the commenter raises, the Agency believes that today's rulemaking will minimize releases of mercury from the storage and transportation of lamps prior to recycling or disposal and will ensure proper management, with the lowest environmental releases of the options considered, when ultimately disposed or recycled.

DCN FLEP-00305
COMMENTER Sierra Club National Solid Waste Comm.
SUBJECT FATE
COMMENT Mercury in the environment is a serious problem in several states, for example Florida, Minnesota, and other Great Lakes states. In Florida, it has become necessary to impose restrictions on fish consumption from most waterbodies in the state. Toxic levels of mercury have been found in wildlife that consume fish as a large portion of their diet, such as the endangered Florida panther. Aggressive action is necessary to reduce the release on mercury into the environment. The conditional exclusion option would be a step in the opposite direction. The data on mercury released from landfills is far too sparse and assumptions are unjustified in reaching the

conclusion that lamps may be safely landfilled, as would be allowed under the conditional exclusion. Studies cited from Switzerland and Sweden may be inappropriate for much of the US because of the higher temperature. Mercury vapor pressure in US landfills, especially those in Florida, could easily be a factor on 10 higher because of the strong dependence of vapor pressure on temperature. No concentrations of mercury in MSW were given in the study from Sweden, which has an aggressive program to remove mercury.

RESPONSE

The Agency agrees with the commenter=s concerns regarding the need for reducing the amount of mercury released to the environment. In today=s rule, the EPA 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 universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

The universal waste rule ensures that mercury emissions are minimized during all stages of lamp management. 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. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. In the Agency=s analysis of mercury air emissions for the current rule and other options considered, the universal waste options all showed lower total air emissions than the current scenario (baseline) or the conditional exclusion.

The Agency shares the commenter=s concern about mercury releases to groundwater from non-hazardous waste management. The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

DCN FLEP-L0001
COMMENTER Environmental Technology Council
SUBJECT FATE
COMMENT Leaching from a solid waste landfill, however, is not the only, and perhaps not the most likely, pathway for mercury from discarded fluorescent lamps to enter the environment and adversely affect the public health. Rather, lamps are broken in transport and storage and in crushing at the landfill, causing mercury to volatilize and enter the atmosphere. [15] [Footnote 15: NJDEPE Report, Vol. III, p. 2.37.] (This fact is ignored in the exclusion option, which does not regulate transportation, storage, or crushing at the landfill.) Once in the atmosphere, mercury subsequently contaminates surface waters and fish, which, in turn, creates public health risks.

Moreover, as noted above, even before the lamps are in the landfill, much of the mercury has escaped to the atmosphere through breakage in transport and storage, and through crushing at the landfill. D. EPA's Arguments for Excluding Fluorescent Lamps Are Refuted by the Mercury TC Level Virtually the entire discussion in the Preamble to the proposed regulation dealing with "impacts" (Section III of the Preamble) focuses on releases of mercury from landfills, not with releases specifically from fluorescent lamps. EPA presents no data, however, demonstrating that fluorescent lamps in landfills are likely to release significantly less mercury than other forms of mercury hazardous waste at similar concentrations.

In practice, mercury is released in the MSW system through breakage in transportation and crushing at the landfill, before even being placed in the landfill itself. Further, mercury has been found at elevated levels in the air near solid waste landfills, in vented gases from landfills, and in nearby soils and wetlands.

Excess mercury has been found in air over landfills, in gas collected from landfills, in landfill leachate and in soil and wetlands near a disposal site for fluorescent lamps. [23] [Footnote 23: Ward B. Stone Letter, footnote 16 above; Risk Assessment, pp. 106, 110, 112.] The concentration of mercury in leachate and vented gas is at levels of concern. [24]

[Footnote 24: Letter from Charles W. Williams, Commissioner of Minnesota PCA, to Mr. Richard J. Guimond and Ms. Sylvia Lowrance, EPA, November 30,1993. p. 2.] Moreover, as the Preamble notes (Section III-A), 12 out of 66 (18 percent) 1990 and 1991 Superfund RODs for landfills accepting municipal waste listed mercury as a Contaminant of Concern. Even if leachate is not leaking from the landfill, the leachate must be treated, during which mercury can volatilize to the atmosphere. If mercury does not volatilize during treatment, it is removed to the treatment sludge. The sludge, in turn, typically is landfarmed or incinerated in a municipal solid waste incinerator, both of which foster direct volatilization and emission of mercury to the atmosphere. Even if such releases were not to be found yet generally at landfills, there is sufficient evidence of releases to be concerned. Any releases of mercury to the environment, after all, will remain in the environment and likely contribute to the growing bioaccumulation of mercury in the food chain (as evidenced, for example, by the growing number of fish advisories for mercury). Moreover, in looking at the above examples for mercury from landfills, one must bear in mind that at only one of these landfills (Rock Dump, Milton, New York) was there a substantial amount of fluorescent lamps disposed. Mercury problems were found at the other landfills without even the kind of concentrated disposal of fluorescent lamps that could occur under the "conditional exemption" proposal. Under a conditional exemption approach, it is quite possible that most fluorescent lamps would be directed toward a relatively small number of solid waste landfills in those states that would be willing to allow this hazardous waste in their solid waste landfills.

RESPONSE

The Agency thanks the commenter for the information on mercury releases. In today=s rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Instead, EPA is adding hazardous waste lamps to the universal waste regulations under 40 CFR Part 273, in part to address the concern that most of the releases of mercury from hazardous waste lamps occur during storage and transport. 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 is less stringent than full Subtitle C management standards).

The universal waste rule represents a significant cost reduction over full Subtitle C

management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

The universal waste rule ensures that mercury emissions are minimized during all stages of lamp management. 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. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. EPA believes that with adequate state oversight, mercury containing lamps can be safely recycled and the mercury reclaimed. 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 practices and the conditional exclusion option, total mercury emissions from lamps are likely to decrease.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-L0008
COMMENTER Duke Power Company
SUBJECT FATE

COMMENT EPA's own scientific data, collected in the Research Triangle Park Report, and data from the recently completed Tetra Tech Report, reconfirms Duke Power's, and EPA'S, original position that disposal and crushing of lamps in solid waste landfills does not present a groundwater or air emissions concern.

RESPONSE

The Agency believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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 has reviewed several additional sources of data on release of mercury to groundwater. These data indicate, contrary to the comment, that mercury can be released from MSWs in significant concentrations to pose threats to human health and the environemnt. Coupled with the fact that lamps are a large source of mercury disposed in MSWs, and the physically and chemically available form of mercury in the lamps, supports the Agency=s conclusion that subtitle C regulation, via the Universal Waste regime, is appropriate. Thus, data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well

supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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-containing lamps under several regulatory approaches.

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. 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).

DCN SCSP-L0009
COMMENTER National Electric Manufacturers Assn.
SUBJECT FATE
COMMENT Minimal Risk in the Municipal Waste Stream NEMAs recommendation that lamps be exempted from the definition of hazardous waste is based on studies, including EPA's report mentioned above, which have demonstrated that mercury is not migrating into the environment from municipal solid waste landfills either through the groundwater or emissions to the air. The report concludes that mercury is bound up within municipal landfills and that the small and dilute amounts released into leachate are not mobile beyond the upper soil layers. The release rate for mercury in landfills is so low that the authors state that there is "little, if any, evidence of adverse impacts of mercury in municipal solid waste on ground-water resources" (RTI report, p.113). Indeed, EPA has been aware for some time that metals behave differently than organics in the sub-surface environment and that they are over-regulated by the Toxicity Characteristic. RTI reaches the same conclusion with respect to landfill gas emissions, finding that the release rate is very low and has no measurable impact on air quality around a landfill. (RTI report, p. 113.)

NEMA Responses to Key Comments on Universal Waste Proposal Comment: Mercury from fluorescent lamps represents a major source of mercury in landfills, is released to the environment, and presents a significant risk, Response: Lamps represent approximately five percent of mercury found in municipal solid waste (RTI Report, p. 78). In contrast, batteries alone represent over 80 percent (RTI Report, p. 78). Lamps, while significant are not a major source of mercury. The comments asserting that mercury is released into the environment from landfills and presents a risk are either not supported by the

commenter with data or citations, or are based on studies that are inadequate. The report prepared by the Minnesota Office of Waste Management [2] [Footnote 2: Report on the Management of Mercury-Containing Lamps (January 1993)] which may have been relied upon by some of the commenters overstates landfill emissions to surface water by assuming: 1) the lamps are disposed of in an uncontrolled landfill and 2) that no dilution or attenuation occurs in the sub-surface environment. Both the EPA RTI study and the data included in NEMA's independent report prepared for the State of Minnesota, dated January 18, 1993, and provided to EPA staff refute these findings. Assertions by MRT (a Swedish recycling company) that there are significant levels of mercury vapor above landfills in Sweden are not supported by the RTI study. In studies submitted separately to Mr. Layland on May 25, 1993, NEMA found that mercury vaporization rates from broken lamps were essentially flat after 40 days, and that 80 percent of the mercury remained in the lamp.

RESPONSE

EPA agrees with NEMA that lamps are a significant source of mercury to the environment, even if they are not a major source. The Agency believes that some RCRA management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

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. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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.

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^{th} 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.

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 the 1992 analysis. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

All field studies identified by the Agency to date have tried to assess total mercury behavior (from all sources) in landfills in proportion to 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 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 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. 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).

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-containing lamps under several regulatory approaches.

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. 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).

DCN FLEP-L0010
COMMENTER United Energy Associates, Inc.
SUBJECT FATE
COMMENT It is our understanding that air-borne Mercury emissions from the stacks of combustion generators pose a much greater environmental hazard than does the potential migration of solid-form Mercury, a situation created by land-filling fluorescent lamps.
RESPONSE

The Agency agrees with the commenter that one of the largest sources of mercury releases to the environment is represented by combustion sources. Today=s rule adds hazardous waste lamps to the universal waste regulations at 40 CFR Part 273. In order to address the commenter=s concern, under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. As a result of this requirement, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks).

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

While most mercury may be released to the environment from combustion, data from CERCLA RODs and the 1996 Hazardous Waste Characteristics Scoping Study on leaching and ground water contamination show that mercury from landfills can contaminate drinking water wells.

DCN SCSP-L0019
COMMENTER New Jersey Dept. of Env. Prot. and En.
SUBJECT FATE
COMMENT In terms of fluorescent bulbs, the Department's Mercury Emission Task Force Report includes a qualitative discussion of the life cycle risk of fluorescent disposal/recycling. The USEPA report, "Municipal Landfill Gas Condensate" by Engineers dated September 1, 1981, indicates a range of values between 0.034 to 0.00069 mg/l for mercury concentrations in landfill gas condensate. Using these concentrations in the USEPA Landfill Gas Emissions Model indicates that sanitary landfills could generate between 6-10 pounds per landfill per year. This rate is projected for 50 years with a cumulative impact of approximately 300 pounds per landfill. New Jersey has a total universe of 518 landfills. This evaluation of mercury in landfill gas condensate, within the discussion of fluorescent bulbs in New Jersey's Mercury Emissions Task Force Report is not an indication that the small percentage of mercury in bulbs is the cause this potential mercury emissions. However, the USEPA report, "Characterization of Products Containing Mercury in Municipal Solid Waste in the United States 1970 to 2000" by Franklin Associates, indicates the mercury in fluorescent bulbs is the only increasing source of mercury in discarded products. With the implementation of the "no added mercury" alkaline battery and the reduction of mercury oxide batteries in the market place, the USEPA Report indicates that fluorescent bulbs, at least in New Jersey, will be the largest source of mercury in the municipal solid waste stream by the year 2000. These facts warrant their consideration within the Universal Waste Rule system.
RESPONSE

The Agency agrees with the commenter=s concerns regarding the disposal of hazardous waste lamps to municipal solid waste landfills. In order to decrease the amount of mercury entering municipal solid waste streams, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps but instead, is adding hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The EPA 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 is less stringent than full Subtitle C management standards).

The universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are

recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

The universal waste rule ensures that mercury emissions are minimized during all stages of lamp management. 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 also 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 storage facilities, although the Agency does not regulate the actual process of reclaiming mercury. In addition, recycling facilities (as well as Adownstream@ 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).

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.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and

(2) boilers that burn hazardous waste.

DCN SCSP-00159
COMMENTER Robert K. Stockett
SUBJECT FATE
COMMENT SUMMARY: TCLP tests have shown many used fluorescent light bulbs are hazardous waste. Used fluorescent light bulbs are generated from a wide variety of sources. Some of these sources, such as households, offices and institutions, are not usually associated with hazardous waste generation. Over 500 million fluorescent light bulbs are discarded each year, most of which end up in the municipal solid waste stream. Fluorescent light bulbs are the second largest source of mercury in municipal waste. Their relative contribution is projected to increase over the next several years.
RESPONSE

The Agency recognizes that hazardous waste lamps are generated by many facilities which are not familiar with or equipped to comply with the full Subtitle C regulatory structure. This structure was initially developed with industrial hazardous wastes in mind, and is most appropriate for these materials and for the types of facilities that generate these wastes. The streamlined universal waste structure is more appropriate for the numerous, widely varied universe of lamp handlers who are not familiar with or easily able to comply with the full hazardous waste regulatory structure. Today's final rule adds hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. As a result of this requirement, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks).

DCN FLEP-00146
COMMENTER Sierra Club/North Star Chapter
SUBJECT FATE
COMMENT CONDITIONAL EXCLUSION WILL RESULT IN GREATER AMOUNTS OF MERCURY ENTERING THE ENVIRONMENT

The conditional exclusion does not include any management standards for the transportation or storage of lamps. Therefore, most lamps will be broken long before they are capped in a landfill during discard, collection,

transportation, compaction, and tipping. Further, mercury continues to be released after the lamps lave been placed in a landfill, through leachate and landfill gas. The mercury present in landfill leachate will eventually be released into the environment through evaporation in the wastewater treatment process, direct effluent discharge, or through management of the sludge.

RESPONSE

The Agency agrees with the commenter=s concerns regarding the potential of mercury releases under the conditional exclusion option. In today=s rule, the EPA 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 universal waste rule ensures that mercury emissions are minimized during all stages of lamp management. 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. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. In the Agency=s analysis of mercury air emissions for the current rule and other options considered, the universal waste options all showed lower total air emissions than the current scenario (baseline) or the conditional exclusion.

The universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing

MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

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-containing lamps under several regulatory approaches. That analysis indicates that mercury air emissions will be minimized under the universal waste approach, when compared with current management scenarios and the conditional exclusion option.

DCN FLEP-00145
COMMENTER ASTSWMO
SUBJECT FATE
COMMENT Mercury is biomagnified in the environment. Mercury is an environmental toxicant and volatile element which cannot be destroyed, and can be transported long distances in the atmosphere from its source. The environmental threat from mercury is compounded due to these factors and the fact that it is biomagnified in the environment as it moves up through the food chain. For these reasons, ASTSWMO is concerned that USEPA may choose to promulgate a national baseline program which would allow municipal solid waste (MSW) landfilling of waste fluorescent lamps via the conditional exclusion proposal. USEPA may assume that those states which so choose can then promulgate more stringent regulations for waste fluorescent lamps if they deem fit. However, mercury does not recognize State boundaries.
RESPONSE

The Agency agrees with the commenter=s concerns regarding the threats posed by mercury to human health and the environment. In today=s rule, the EPA 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 universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Therefore, it is expected that fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal

combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

The universal waste rule ensures that mercury emissions are minimized during all stages of lamp management. 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. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. In the Agency=s analysis of mercury air emissions for the current rule and other options considered, the universal waste options all showed lower total air emissions than the current scenario (baseline) or the conditional exclusion.

Today's final rule provides a uniform approach for the regulatory status of spent lamps, at least at the federal level; however, individual states may have more stringent requirements for the management of this waste. Today's rule becomes effective in states that are not authorized for the federal Subtitle C hazardous waste program, but will not be immediately effective in authorized states, since the requirements are not promulgated pursuant to HSWA. These requirements will not be effective in authorized states until such states revise their solid waste management programs to adopt equivalent requirements. EPA is encouraging states to adopt today's final rulemaking that adds hazardous waste lamps to the federal universal waste program.

DCN FLEP-00191

COMMENTER Utility Solid Waste Activities Group
SUBJECT FATE
COMMENT D. Maximum Participation in Green Lights and Similar Programs - Which Will Occur Under the MSWLF Option - Will Result In Reduced Mercury Loadings to the Environment From a policy perspective, the MSWLF option will undoubtedly result in the greatest reduction in mercury loadings to the environment. Therefore, unless there is a technical or legal bar to pursuing this option - which there is not -- common sense and sound environmental policy dictate that EPA pursue this alternative.
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. 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 commenter=s praise of the MSWL disposal option is not fully supported by the facts. 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. 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 data in CERCLA RODS 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 Alandfill or Adump@ 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.

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^{th} 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.

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 the 1992 analysis. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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 wells in future years.

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-containing lamps under several regulatory approaches. That analysis indicates that mercury air emissions will be minimized under the universal waste approach, when compared with current management scenarios and the conditional exclusion option.

The Agency believes that management controls are necessary to minimize releases of mercury and other hazardous constituents to the environment during lamp accumulation, storage, and transport; to ensure safe handling of such lamps; and to keep hazardous waste lamps out of municipal waste facilities (both landfills and solid waste incinerators). 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. The EPA has recently published a Mercury Study Report to Congress (December 1997) 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., AMad Hatters= 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.

EPA studies have shown that participation in energy-efficient lighting programs such as Green Lights reduces mercury (as well as other pollutant) air emissions from the burning of fossil fuels for electricity generation. The amount of air emissions produced from the generation of electricity will continue to decrease with less demand for electricity due to energy-efficiency savings. The universal waste rule should not affect participation in energy-efficient lighting programs. A significant number of commenters indicated that savings from reduced energy usage more than covers the cost of managing lamps as hazardous waste.

DCN FLEP-00228
COMMENTER STAPPA/ALAPCO
SUBJECT FATE
COMMENT Exemption of mercury-containing lamps from the hazardous waste system fails to address the environmental impacts of mercury emissions and is inconsistent with the current state and federal focus on reducing the release of bioaccumulative chemicals of concern (BCCs) to the environment.
RESPONSE
The Agency agrees with the commenter=s concerns regarding the environmental impacts of mercury emissions. In today=s rule, the EPA 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 universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly

treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

The Agency believes that today's rulemaking will not interfere with state or regional efforts to address problems with the bioaccumulation of mercury in the environment. Today's rulemaking is designed to minimize the potential emissions during the management of hazardous waste lamps. Individual states may have more stringent requirements for the management of this waste. Today's rule becomes effective in states that are not authorized for the federal Subtitle C hazardous waste program, but will not be immediately effective in authorized states since the requirements are not promulgated pursuant to HSWA. These requirements will not be effective in authorized states until such states revise their solid waste management programs to adopt equivalent requirements. EPA is encouraging states to adopt today's final rulemaking that adds hazardous waste lamps to the federal universal waste program.

DCN FLEP-00282
COMMENTER Michigan Dept. of Natural Resources
SUBJECT FATE
COMMENT Environmental Impacts Exemption of mercury-containing lamps from the hazardous waste system fails to address the environmental impacts of mercury and is inconsistent with the current State and Federal focus on reducing the release of bioaccumulative chemicals of concern (BCCs) to the environment. In the Great Lakes Basin, a Great Lakes Mercury Task Force has been established in Region 5 that includes EPA and Great Lakes states representatives. The States of Minnesota and Michigan have also convened Mercury Task Forces. The Great Lakes Water Quality Agreement and the proposed Great Lakes Water Quality Guidance

are all committed to reducing loadings of bioaccumulative toxic substances to the Great Lakes Ecosystem. Mercury is among the BCCs chosen under a special Virtual Elimination Project undertaken by U.S. EPA's Great Lakes National Program Office (GLNPO) as a part of a Region 5 Great Lakes Toxic Reduction Effort. Mercury is also one of nine chemicals targeted for zero discharge and zero emission per the Binational Program to Restore and Protect the Lake Superior Basin. Canada also has highlighted mercury as a priority pollutant of concern.

RESPONSE

The Agency agrees with the commenter=s concerns regarding the environmental impacts of mercury emissions and recognizes it as a high-priority pollutant. In today=s rule, the EPA 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 universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

The Agency believes that today's rulemaking will not interfere with state or regional efforts to address problems with the bioaccumulation of mercury in the environment. Today's rulemaking

is designed to minimize the potential emissions during the management of hazardous waste lamps. Individual states may have more stringent requirements for the management of this waste. Today's rule becomes effective in states that are not authorized for the federal Subtitle C hazardous waste program, but will not be immediately effective in authorized states since the requirements are not promulgated pursuant to HSWA. These requirements will not be effective in authorized states until such states revise their solid waste management programs to adopt equivalent requirements. EPA is encouraging states to adopt today's final rulemaking that adds hazardous waste lamps to the federal universal waste program.

DCN FLEP-00301
COMMENTER Minnesota Pollution Control Agency/MOEA
SUBJECT FATE
COMMENT 11. The CE Alternative Allows Lamps to Continue to be a Significant Source. The CE alternative is based on outdated and inaccurate information regarding mercury and its behavior in solid waste facilities and the environment. The CE alternative does not address multimedia issues associated with mercury management and contamination. The CE alternative downplays the significant releases that would undoubtedly happen during the discarding, breakage, storage, on-site crushing, transportation, tipping, and compaction of lamps. Current limited data for landfill leachate, gas emissions, and lamp breakage indicate mercury releases at level of concern. While some argue that annual mercury emissions from individual landfills are insignificant, the true impact must be measured based on the cumulative emissions over time, including long after landfill closure. Landfills incubate methyl mercury. Research shows that direct emissions of methyl mercury are occurring.

F. Emissions from Mismanagement under the CE alternative. The CE alternative is unworkable due to the complexity of the solid waste management system in this country. The CE alternative is based on an uncomplicated model of the solid waste management system (see Figure 1). [Figure 1: An Uncomplicated View of the MSW Management System. (See hard copy of Comment FLEP-00301)] In such a model, there are no releases in collection and transportation. Solid waste is delivered to either landfills or incinerators and there is perfect control over where waste goes. In this model, incinerators have effective emission controls and there are no releases of concern. Once in a landfill, ash or solid waste and all constituents are entombed without releases

to the environment. However, the solid waste system in the real world is extremely complicated. There is little if any control over where waste goes once it is collected and in fact it may go to several facilities prior to reaching the final destination. There are numerous release pathways to air, ground water, surface water, and soil during this collection, transportation and disposal process. When releases to an environmental pathway are restricted in one place, they tend to increase in another. See Figure 2 for a generalized view of the real world solid waste management and environmental release system. [Figure 2: A Generalized Diagram of Waste Flow in Integrated MSW Management. (See hard copy of Comment FLEP-00301.)] In the real world, we are not able to prevent lamp breakage in solid waste collection, keep lamps out of incinerators or processing facilities, and confine mercury in landfills or other solid waste management facilities. Even if a special separate collection system were to be established for those who need to deliver their waste from an incinerator to a landfill, mismanagement would be prevalent due to the reality of the unenforceability and confusion of such a system, not to mention the ease by which generators may place lamps in with their regular trash without detection.

RESPONSE

The Agency thanks the commenter for the information on the behavior of mercury in the environment. In today=s rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps but instead, is adding hazardous waste lamps to the universal waste regulations under 40 CFR Part 273 in part to address the commenters= concerns regarding releases of mercury from hazardous waste lamps during storage and transport. The EPA 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 is less stringent than full Subtitle C management standards).

The universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Therefore, it is expected that fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility. In choosing the universal waste option, the Agency is promulgating the approach that will result in the lowest release of mercury from lamps of the

options considered. This includes both minimizing releases to air and to groundwater, as shown by EPA=s Mercury Emissions Report and data from mercury releases to groundwater and well contamination identified in CERCLA RODs and the 1996 Hazardous Waste Characteristics Scoping Study.

The universal waste rule ensures that mercury emissions are minimized during all stages of lamp management. 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. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities.

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

DCN FLEP-00309
COMMENTER Bethlehem Apparatus Company
SUBJECT FATE
COMMENT D. OPTION 1 - THE CONDITIONAL EXCLUSION DOES NOT ADEQUATELY PROTECT THE ENVIRONMENT. The exclusion of lamps from the hazardous waste stream is a short-sighted attempt to reduce perceived regulatory burdens. Unregulated shipment, consolidation and disposal could dramatically impact the amount of mercury released to the environment at many locations and at many different levels. Imagine the impact of one large scale relamping if the waste Lamps were disposed of as MSW. Instead of separate containers being used for the careful packaging of Lamps, a roll-off 30-cubic yard container or 6-cubic yard

dumpster becomes the initial repository for the disposal of Lamps. These containers become mini-compactors as Lamps and additional refuse is piled in. Mercury is released to the container upon breakage in liquid form and in vapor form to the atmosphere and unsophisticated workers who load the container. These containers are now potentially permanently contaminated for all future uses. Next, if a compactor truck disposes of the Lamps, it too will be contaminated, spilling mercury along the road as it goes to the landfill. Finally, the mass of broken Lamps are dumped in one location into the landfill, crushed and compacted, exposing the landfill workers to mercury vapor and creating a mercury hot spot and potential contaminant slug in the landfill. The conditional exclusion makes no sense from an environmental and worker health and safety perspective, little sense from an economic perspective and would appear to run afoul of RCRA's mandate to recycle and recover hazardous wastes. Accordingly, it should be rejected by EPA.

RESPONSE

The Agency agrees with the commenter that the conditional exclusion option would allow some mercury management practices that may not adequately protect human health and the environment. In today=s rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps but instead, is adding hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The EPA 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 is less stringent than full Subtitle C management standards).

The universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

In choosing the universal waste option, the Agency is promulgating the approach that will result in the lowest release of mercury from lamps of the options considered. This includes both minimizing releases to air and to groundwater, as shown by EPA=s Mercury Emissions Report and by data from mercury releases to groundwater and well contamination identified in CERCLA RODs and the 1996 Hazardous Waste Characteristics Scoping Study.

The universal waste rule ensures that mercury emissions are minimized during all stages of lamp management. 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 also 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 storage facilities, although the Agency does not regulate the actual process of reclaiming mercury. In addition, recycling facilities (as well as Adownstream@ 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).

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-L0001
COMMENTER Environmental Technology Council
SUBJECT FATE
COMMENT To exempt mercury in fluorescent lamps from hazardous waste regulations, "conditionally" or otherwise, would be entirely contrary to EPA policy on mercury, which recognizes mercury's serious threat to the environment and public health. Further, because mercury disperses widely in the atmosphere, creating problems at locations far distant from the point of generation, it is a national problem. A state may have strong regulations and vigorous enforcement, and still be unable to control the amount of mercury in its environment. Therefore, any regulation that would rely on a patchwork quilt of varying state and local regulations and enforcement policies and resources, such as under the proposed "conditional exclusion" option, cannot begin to cope with the national nature of the problem. The federal government must establish fully protective, effective, uniform regulations for control of mercury wastes, including mercury-containing fluorescent lamps.
RESPONSE

In today=s rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps but instead, is adding hazardous waste lamps to the universal waste regulations under 40 CFR Part 273. The EPA 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 is less stringent than full Subtitle C management standards).

The universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility. In choosing the universal waste option, the Agency is promulgating the approach that will result in the lowest release of mercury from lamps of the options considered. This includes both minimizing releases to air and to groundwater, as shown by EPA=s Mercury Emissions Report and data from mercury releases to groundwater and well contamination identified in CERCLA RODs and the 1996 Hazardous Waste Characteristics Scoping Study.

The universal waste rule ensures that mercury emissions are minimized during all stages of lamp management. 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 also 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 storage facilities, although the Agency does not regulate the actual process of reclaiming mercury. In addition, recycling facilities (as well as Adownstream@ 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).

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.

The Agency believes that today's rulemaking will not interfere with state or regional efforts to address problems with the bioaccumulation of mercury in the environment. Today's rulemaking is designed to minimize the potential emissions during the management of hazardous waste lamps. Individual states may have more stringent requirements for the management of this waste. Today's rule becomes effective in states that are not authorized for the federal Subtitle C hazardous waste program, but will not be immediately effective in authorized states since the requirements are not promulgated pursuant to HSWA. These requirements will not be effective in authorized states until such states revise their solid waste management programs to adopt equivalent requirements. EPA is encouraging states to adopt today's final rulemaking that adds hazardous waste lamps to the federal universal waste program.

DCN FLEP-00145
COMMENTER ASTSWMO
SUBJECT FATE
COMMENT Mercury is also released when lamps are broken during landfilling. Mercury is released from lamp residues within the landfill, and is ultimately released in landfill leachate, landfill gases, and landfill gas condensates. USEPA has stated in the rule proposal that current MSW landfill monitoring suggests that landfilling of lamps may be safe due to data the Agency has collected indicating that mercury may not leach from MSW landfills above the Maximum Contaminant Levels (MCLs) for drinking water supplies. However, USEPA states later in the proposal that in fact mercury was found to exceed the MCL in landfill leachate for seven percent (7%) of the samples analyzed. Many MSW landfills that meet 40 CFR 258 requirements (i.e., liners, leachate collection and ground water monitoring) allow landspreading of the leachate which would contribute to mercury contamination. ASTSWMO does not agree with USEPA's interpretation that MSW landfilling of waste fluorescent lamps may be protective of human health and the environment since leachate concentrations at MSW landfills do not indicate a large drinking water threat due to mercury contamination. In fact, the USEPA acknowledged later in the rule proposal that "The behavior of mercury in a MSW landfill is not known in great detail." We strongly believe that it is the obligation of USEPA to require management of waste fluorescent lamps outside of the MSW stream until such time as the Agency can show definitively that the lamps present no hazard to human health and the environment when managed as MSW and disposed of in MSW landfills.

The conditional exclusion would not ensure protection to human health and the environment due to the reasons listed above, and also because mercury has been found in landfill gas emissions.

Once again, ASTSWMO believes that USEPA must show definitively that mercury emissions from landfill gases and landfill gas condensates would present no significant hazard to human health and the environment prior to allowing MSW landfilling of waste fluorescent lamps.

RESPONSE

In today=s rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps but instead, is adding hazardous waste lamps to the universal waste regulations under 40 CFR Part 273 in part because the Agency has similar concerns to the commenter=s regarding the long-term behavior of mercury in different types of landfills. The EPA 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 is less stringent than full Subtitle C management standards).

The universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility.

The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at distances up to a mile and a half from the contamination source. Numerous other groundwater samples had mercury concentrations equal or greater than 10% of the MCL.

These data clearly show that mercury can leach from MSW and other landfills, and can be

transported in groundwater over significant distances, and that transport occurs at concentrations that are environmentally significant. Current regulatory levels for mercury in waste are well supported by these data, and management of mercury waste exceeding the TC levels in Subtitle D units is clearly inappropriate.

These data could be used to update the Agency=s 1992 analysis of mercury releases to groundwater from landfills in the RTI report, and would undoubtedly show an increased rate of mercury release. However, and more significantly, these data show not only mercury release 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. Given these data, estimates of the fraction of mercury released from landfills via leaching (as the Agency did in the RTI report) are largely irrelevant to the question of the risks to the environment posed by landfill disposal of mercury waste. 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 show clear significant risk to the environment and water consumers.

The additional data from the CERCLA RODs expands both the number and type of sites examined and covers a longer time period. 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 RODs 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. 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.

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 per year of mercury (see Table 4-1 of the RTI study, 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

wells in future years.

DCN FLEP-00146
COMMENTER Sierra Club/North Star Chapter
SUBJECT FATE
COMMENT CONDITIONAL EXCLUSION WILL RESULT IN GREATER AMOUNTS OF MERCURY ENTERING THE ENVIRONMENT

The conditional exclusion does not include any management standards for the transportation or storage of lamps. Therefore, most lamps will be broken long before they are capped in a landfill during discard, collection, transportation, compaction, and tipping. Further, mercury continues to be released after the lamps lave been placed in a landfill, through leachate and landfill gas. The mercury present in landfill leachate will eventually be released into the environment through evaporation in the wastewater treatment process, direct effluent discharge, or through management of the sludge.

RESPONSE

In today=s rule, the Agency is not finalizing the conditional exclusion option for the management of hazardous waste lamps. Instead, EPA is adding hazardous waste lamps to the universal waste regulations under 40 CFR Part 273, in part to address the commenter=s concerns regarding releases of mercury from hazardous waste lamps during storage and transport. The EPA 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 is less stringent than full Subtitle C management standards).

The universal waste rule represents a significant cost reduction over full Subtitle C management requirements for generators, collectors, and transporters, yet ensures that lamps are recycled or treated in an environmentally protective manner at Subtitle C hazardous waste facilities. Therefore, it is expected that fewer hazardous waste lamps will be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks). Once the lamps are properly treated and no longer hazardous waste, the treated lamps may be disposed in a solid waste facility. In choosing the universal waste option, the Agency is promulgating the approach that will result in the lowest release of mercury from lamps of the options considered. This includes both minimizing releases to air and to groundwater, as shown by EPA=s Mercury Emissions Report and data from mercury releases to groundwater and well contamination identified in CERCLA RODs and the 1996 Hazardous Waste Characteristics Scoping Study.

The universal waste rule ensures that mercury emissions are minimized during all stages of lamp management. 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. Under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities.

DCN SCSP-00199
COMMENTER Minnesota Office of Waste Management
SUBJECT FATE

As discussed below, mercury releases to the environment are increasingly being recognized as a problem in the municipal solid waste system.

Mercury-containing lamps are the second largest source of mercury in the mixed municipal solid waste stream (MSW), following batteries. The mercury content of batteries can be significantly reduced or eliminated. This is now occurring, and fluorescents are likely to become the largest source of mercury in the MSW stream. Unfortunately, mercury is essential to lamp operation and mercury content cannot be significantly reduced without adversely affecting lamp life and increasing the costs and impacts of lighting.

Difficulty of Controlling Mercury in Municipal Solid Waste Facilities

Incineration of mercury-containing wastes causes an immediate and direct release of mercury to the atmosphere. Mercury emissions from incinerators are very difficult and expensive to control, and the best control method is to keep these materials out of incinerators. Incineration of lamps and other mercury-containing wastes should be prohibited.

Mercury-containing lamps should also be kept out of MSW composting facilities, since the processing involved will lead to rapid release of airborne mercury. The mechanical shredding of MSW and the aeration and increased temperatures in the piles results in evaporation and release of mercury. The finished compost may also contain levels of mercury that exceed state and federal limits. The vapor pressure of mercury adsorbed on phosphor powder at room temperature is higher than the Occupational Safety and Health Administration (OSHA) standards for worker exposure, and it quadruples with every ten degree rise in temperature.

Landfills do not provide effective mercury control either, since mercury evaporates and is present in landfill air emissions and in leachate and gas condensate. Mercury is still released from landfilled wastes; it is simply released over a longer period of time. For this reason, the OWM does not believe that the landfilling of lamps is an appropriate waste management method.

RESPONSE

The Agency agrees with the commenter that disposal of mercury-containing wastes in municipal solid waste incinerators and landfills result in releases of mercury to the environment. Today=s rule adds hazardous waste lamps to the universal waste regulations of 40 CFR Part 273. In order to address this concern, under the universal waste rule, destination facilities (i.e., facilities that treat, dispose, or recycle universal wastes) are subject to all hazardous waste management requirements applicable to permitted or interim status hazardous waste treatment, storage, and disposal facilities. As a result of this requirement, fewer hazardous waste lamps are expected to be managed in the municipal solid waste stream, therefore reducing the number of lamps going to municipal combustors and landfills and decreasing the potential for lamps to be crushed and/or broken in uncontrolled environments during storage and transport (e.g., dumpsters and garbage trucks).

Simultaneously with the effort to modify the management of hazardous waste lamps, the Agency has been actively pursuing regulation of mercury air emissions from a wide variety of other sources. On December 19, 1995, EPA issued a final rule limiting emissions of mercury and other pollutants from large municipal waste combustors (60 FR 65387). Subsequently, on September 15, 1997, EPA issued a final rule setting emission limits for mercury (and other pollutants) for medical waste incinerators (62 FR 48348) (remanded for further explanation, *Sierra Club v. EPA*, 167 F.3d 658 (D.C. Cir. 1999)). In addition, the Agency finalized a rule that sets performance standards for new municipal solid waste landfills (MSWLF) and emission guidelines for existing MSWLF (61 FR 9905; March 12, 1996)). Lastly, on April 19, 1996, the Agency proposed a rule that would limit emissions of various air pollutants including mercury from hazardous waste incinerators, cement kilns, and lightweight aggregate kilns (61 FR 17358, finalized in part, 63 FR 33782 (June 19, 1998)). In the future, EPA is planning to propose two rules to address (1) air emissions from industrial and commercial waste incinerators that burn non-hazardous waste, and (2) boilers that burn hazardous waste.

In choosing the universal waste option, the Agency is promulgating the approach that will result in the lowest release of mercury from lamps of the options considered. This includes both minimizing releases to air and to groundwater, as shown by EPA=s Mercury Emissions Report and data from mercury releases to groundwater and well contamination identified in CERCLA RODs and the 1996 Hazardous Waste Characteristics Scoping Study.

The Agency agrees that mercury in municipal solid waste landfills is of concern. The Agency has reviewed several additional sources of data on release of mercury to groundwater. Data from the 1996 Hazardous Waste Characteristics Scoping Study , CERCLA program Records of Decision (RODs), and preliminary data from an ongoing Agency study of landfill leachate were reviewed. Mercury contamination was identified as a problem at a significant number of the sites identified. These data show mercury leaching from MSW landfills at a concentration equal to 30% of the TC concentration, and numerous groundwater wells with mercury concentrations equal to or greater than the MCL. Two RODs identified the wells as residential drinking water wells at

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