EXHIBIT LIST

IN THE MATTER OF:	)	
	)	
STANDARDS FOR UNIVERSAL WASTE MANAGEMENT, AMENDMENTS TO 35 ILL. ADM. CODE 703, 720, 721, 724, 725, 728, and 733	)	R05-8 (Rulemaking - Land)

Exhibit 1 Resume of Mark L. Crites, Environmental Protection Engineer with Illinois Environmental Protection Agency

Exhibit 2 Economic Analysis of Including Mercury Containing Devices in the Universal Waste System, Notice of Proposed Rulemaking, USEPA Office of Solid Waste, February 15, 2002

Mark L. Crites

Experience

1990 to Present: Environmental Protection Engineer

Illinois Environmental Protection Agency
Bureau of Land, Permit Section, RCRA Unit

Responsibilities:

- Illinois EPA's contact person and technical expert on the Universal Waste Rule and related statutes.
- Illinois EPA's contact person and technical expert on hazardous waste delisting.
- Review applications and write permits for hazardous waste management facilities.
- Review site remediation plans for state and federal clean-up programs to determine Applicable or Relevant and Appropriate Regulations with regard to the hazardous waste management system.
- Evaluate closure by removal demonstrations for hazardous waste management units.
- Inspect hazardous waste management facilities to resolve permitting issues.
- Respond to correspondence from the public and the regulated community regarding technical interpretations of the hazardous waste regulations and statutes.

Education

1990 to Present: Ongoing professional continuing education in a variety of topics including engineering, chemistry, geology, hydrogeology, mathematics, computer modeling, risk assessment, technical writing, project management, new regulations, software-specific courses, and others.

1985 to 1990: Bachelor of Science Mechanical Engineering, Southern Illinois University at Carbondale, Spring 1990.

Licensing and Certification

- State of Illinois Professional Engineer in Training
- OSHA HAZWOPER General Site Worker
- Red Cross CPR and First Aid
- Total Quality Management Facilitator

Exhibit 1
R05-8
12/15/04
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ECONOMIC ANALYSIS OF INCLUDING MERCURY CONTAINING DEVICES IN THE UNIVERSAL WASTE SYSTEM, NOTICE OF PROPOSED RULEMAKING

U.S. Environmental Protection Agency
Office of Solid Waste

February 15, 2002

Exhibit 2
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1. Introduction

Mercury-containing devices (MCDs) might be found in almost any household, business, industry, and institution in the United States. Mercury is commonly used in thermometers, electrical components (such as switches and relays), gauges, meters, and other devices. The amount of mercury in a single device generally ranges from less than one gram to more than 400 grams, although some devices may contain more than 200 pounds of mercury.

The mercury contained in most MCDs is sufficient to classify them, once discarded, as D009 characteristic mercury wastes under RCRA.[1] As a result, commercial, industrial, and institutional entities that discard (i.e., generate) post-consumer MCDs must comply with RCRA generator requirements, which include storage limits, manifesting, recordkeeping, safety training, and biennial reporting by large generators. Under current RCRA regulations at 40 CFR 268.40, discarded MCDs must be sent to a recycler for roasting or retorting or to a Subtitle C landfill (only if the mercury content in the device is less than 260 parts per million and the mercury has been treated to below certain standards). Households and conditionally exempt small quantity generators (those that produce less than 100 kilograms of hazardous waste per month) are not subject to these requirements.

Due in part to the ubiquitous nature of MCDs, the sporadic frequency with which they are discarded, and the fact that many consumers of these devices are not aware of the hazards associated with them, many post-consumer MCDs are often disposed of (both accidentally and non-accidentally) in municipal solid waste (MSW) landfills or incinerators, rather than being recycled. The additional administrative, storage, transportation, treatment, and disposal costs associated with recycling RCRA hazardous waste also serve to discourage recycling of post-consumer MCDs.

In order to encourage more recycling of post-consumer MCDs, EPA is considering adding these devices to the list of Universal Wastes under 40 CFR Part 273. The inclusion of these devices under the Universal Waste regulations is expected to decrease the costs of complying with RCRA requirements (e.g., by exempting MCDs from manifesting and interim storage permit requirements) and, as a result, will make recycling a relatively more economical disposal option.

The purpose of this analysis is to analyze the incremental costs and costs savings associated with including post-consumer MCDs (excluding thermostats) in the Universal Waste system. The remainder of this analysis is organized in nine sections and three appendices.

2. General Overview of Devices and Regulated Entities

This section provides information on the types of MCDs that are of concern to EPA, and generally describes the entities involved in generating, handling, transporting, and recycling them.

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[1] Specifically, most MCDs have a mercury concentration of 0.2 mg/L (ppm) or greater when tested using the Toxicity Characteristic Leaching Profile (TCLP).

2.1 Mercury-Containing Devices

For purposes of this report, MCDs are defined as any device that contains metallic mercury as a component necessary for its operation, with the exception of thermostats, lamps, and batteries.[2] MCDs can be divided into four general categories:

- Thermometers;
- Switches and relays;
- Gauges and meters; and
- "Other devices."

For each of these categories, Exhibit 2-1 lists a number of specific MCDs along with quantities of mercury commonly found in them.

2.2 Regulated Entities Under Current RCRA Regulations

Under current RCRA regulations, entities involved in the MCD lifecycle are regulated if they fall into one of the following categories: generators; transporters; or treatment (including recycling), storage, and disposal facilities (TSDFs).

Generators

Because MCDs contain mercury and are hazardous wastes when discarded, any entity that uses these devices may be a regulated generator.[3] Moreover, the ubiquitous nature of MCDs suggests that the number of regulated generators may be large. Generators can be grouped into three categories:

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[2] EPA has previously classified discarded mercury-containing thermostats and lamps as universal wastes (60 FR 25491, 64 FR 36465). In addition, Title II of the Mercury-Containing and Rechargeable Battery Management Act (1996) mandated a phase out of mercury-containing batteries in the U.S.

[3] Households that generate post-consumer MCDs are excluded from RCRA regulations and are not modeled in the analysis.

Exhibit 2-1
Overview of Mercury-Containing Devices Potentially Generated by Commercial, Industrial, and Institutional Entities

Device Category	Example Devices	Reported Mercury Content (grams per device)
Thermometers	Clinical thermometers (oral/rectal/baby and basal temperature), laboratory thermometers, industrial thermometers, air/water temperature thermometers, veterinary thermometers, Mason's Hygrometers, sling psychrometers	2 ("typical") 0.5 - 0.61 (fever) 2.25 (basal temperature) 3 - 10 (laboratory) 5 (veterinary) 5.56 - 19.78 (industrial)
Switches and Relays	Tilt switches, float switches, silent light switches, mercury reed switches, metal switches, telephone switches, glass switches, alarm switches, limit switches, mercury-wetted relays, displacement/plunger relays, reed relays, flame sensors, pilot light sensors, gas safety valves, rectifiers, ignitron tubes, G-sensors, oscillators, phanatrons, proximity sensors, capacitors	3.5 ("typical") 2.6 (silent light switch) 3.5 - 3,600 (industrial switch) 1 (float switch) 0.5 - 1 (automotive light switch) 2 (chest freezer light switch) 2 (washing machine light switch) 3 (anti-lock brake switch) 1 - 2 (ride control system switch) 0.14 - 3 (mercury reed relay) 160 (displacement relay) 2.5 (flame sensor)
Gauges and Meters	Manometers, barometers, sphygmomanometers, vacuum meters, flow meters, temperature gauges, pressure relief gauges, water treatment pressure gauges, regulators, airway controllers, permeters, hagenmeters, ring balances	330 (sphygmomanometer) 395 (barometer) 85 - 355 (typical manometer) 91,000 (large manometer)
Other Devices	Tubes/dilators (gastrointestinal tubes, esophageal tubes, cantor tubes, Miller Abbot tubes, feeding tubes), recoil suppressors, variable-force counterweight wheels, printed circuit boards	170 (recoil suppressor) 1,000 (dilator)

Sources: Lake Michigan Forum (1999), Michigan Mercury Pollution Prevention Task Force (1996), The Pollution Prevention Partnership and the Milwaukee Metropolitan Sewerage District (1997), SAIC and RTI (1999), U.S. EPA (1992), U.S. EPA (1997a), USWAG (1996), and Wisconsin Department of Natural Resources (1997).

- Entities that produce less than 100 kilograms (kg) per month of post-consumer MCDs and/or other hazardous wastes are *conditionally exempt small quantity generators (CESQGs)*. CESQGs are subject to limited waste management requirements (40 CFR 261.5), and are not modeled in this analysis.

- Entities that produce between 100 and 1,000 kg per month of post-consumer MCDs and/or other hazardous wastes are *small quantity generators (SQGs)* and must comply with manifesting, recordkeeping, and safety training requirements (40 CFR Part 262 generally). SQGs may store hazardous wastes on site for up to 180 days without a permit.

- Entities that generate more than 1,000 kg per month of post-consumer MCDs and/or other hazardous wastes are *large quantity generators (LQGs)*. LQGs must comply with the same requirements as SQGs, except that they may store hazardous wastes on site for no more than 90 days, rather than 180, without a permit. LQGs must also comply with biennial reporting requirements.

Transporters

Under current RCRA regulatory requirements, transporters of post-consumer MCDs are required to be certified as hazardous waste handlers (40 CFR Part 263), and must follow DOT's hazardous materials regulations in 49 CFR 171 through 180. Transporters must obtain an EPA identification number, comply with the manifest system, and properly handle discharges of hazardous waste. In addition, transporters may store post-consumer MCDs at transfer facilities (e.g., loading docks, parking areas) for up to 10 days.

Treatment, Storage, and Disposal Facilities (including Recyclers)

Based on the quantities of mercury in MCDs along with the overall weight of these devices (which can vary from less than one pound to over 1,500 pounds), discarded MCDs are likely to fall into the category of inorganic "high mercury wastes," which are defined as inorganic wastes with a total mercury concentration of greater than or equal to 260 mg/kg (or ppm).[4] As a result, post-consumer MCDs are required, under 40 CFR 268.40, to be recycled through roasting or retorting, which entails placing the waste in a thermal processing unit that allows for volatilization of the mercury and subsequent condensing of the mercury for recovery. This process is referred to as "RMERC" in 40 CFR 268.40.[5]

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[4] In order to not be classified as a high mercury waste, a device would need to have less than one gram of mercury for every 8.5 pounds of total device weight. This is not likely for most MCDs given that MCDs with small amounts of mercury (e.g., thermometers, temperature probes, switches) also tend to be relatively lighter in weight. Any post-consumer MCDs with a total mercury concentration less than 260 mg/kg (or ppm) would be classified as "low mercury wastes." These wastes are not required to be recycled, but must be treated (stabilized) in order to meet a standard of 0.025 mg/L TCLP mercury prior to be land disposed.

[5] In contrast to post-consumer MCDs, high mercury wastes that contain organics may be either incinerated ("IMERC") or recycled.

Entities that recycle MCDs are subject to full RCRA Subtitle C regulations, and must obtain a permit and meet administrative and technical standards (40 CFR Parts 264, 265, and 270).

2.3 Regulated Entities Under Universal Waste Regulations

Under the Universal Waste regulations (40 CFR Part 273), entities involved in the MCD lifecycle would be regulated if they fall into one of the following categories: handlers, transporters, or destination facilities.

Handlers

MCD handlers would include all entities that discard post-consumer MCDs and that are not explicitly excluded from the Universal Waste requirements.[6] These include LQGs, SQGs, and CESQGs. Regulated handlers would also include entities that receive discarded MCDs from other handlers, accumulate the devices over a period of time, and then send the devices on to other handlers, recyclers, or TSDFs.[7] These handlers are generally referred to as "consolidation facilities."

Handlers can be grouped into two categories based on the amount of waste they accumulate:

- Entities that accumulate less than 5,000 kg of universal waste at any time are *small quantity handlers of universal waste (SQHUWs)*, and are subject to requirements for accumulation time (up to one year), proper management of waste, response to releases, and employee training.

- Entities that accumulate 5,000 kg or more of universal waste at any time are *large quantity handlers of universal waste (LQHUWs)*. LQHUWs are subject to the same requirements as SQHUWs, but also must maintain basic shipment records, obtain an EPA identification number, and comply with stricter employee training requirements. Also, designation as a LQHUW is retained through the end of the calendar year in which LQHUW status is attained (i.e., 5,000 kg or more of universal waste is accumulated).

Transporters

Under the Universal Waste regulations, transporters of discarded MCDs would be defined as any entity that transports these devices from handlers to other handlers, TSDFs/recyclers, or foreign destinations (40 CFR 273.10). Transporters of discarded MCDs

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[6] Households that are handlers of post-consumer MCDs would be excluded from the Universal Waste regulations.

[7] An example of such a handler would be the Honeywell Corporation, which established a "reverse distribution network" in 1994 whereby it collects discarded mercury-containing thermostats from other users and recycles them. (U.S. EPA, 1997c)

would not be required to be certified as hazardous waste handlers under 40 CFR Part 263 and would not be required to prepare shipping manifests. In addition, transporters would be able to store discarded MCDs at transfer facilities (e.g., loading docks, parking areas) for up to 10 days.

Although not required to meet RCRA hazardous waste regulations, transporters shipping post-consumer MCDs generally would be required to meet DOT's hazardous materials requirements (49 CFR Parts 171 through 180) *unless* the total quantity of mercury in *each package* (i.e., the "reportable quantity," or "RQ") is less than one pound (49 CFR 172.101, Appendix A). Additional conditions for the exemption of post-consumer MCDs from the DOT hazardous materials requirements are found in 49 CFR 173.164.[8]

Destination Facilities (including Recyclers)

Under the Universal Waste regulations, destination facilities for discarded MCDs would include any facility that treats, disposes of, or recycles these devices. Like the TSDFs described in Section 2.2, these facilities are subject to full RCRA Subtitle C regulations, including permit requirements and both general and unit-specific facility standards. Destination facilities must also maintain records of shipments of discarded MCDs that are received, but they are not required to complete, transmit, and file manifests (i.e., because manifests are not required for universal waste shipments).

3. Preliminary Research and Analysis

This section describes the results of preliminary research conducted in order to identify the number of entities potentially affected by the rule and to characterize MCD disposal prices, transportation costs, and administrative costs.

3.1 Number of Potentially Affected Generators of MCDs

For the purpose of this analysis, an "MCD-only" generator is defined as one that is regulated as a hazardous waste generator for MCDs only, and not any other type of hazardous waste. An "MCD-plus" generator is defined as a generator that is regulated for other types of hazardous waste but also generates MCDs. As described in Section 3.1.1, MCD-only generators are not expected to be affected by this rulemaking because they are all estimated to be CESQGs.

3.1.1 MCD-Only Generators

Preliminary research conducted for this analysis yielded insufficient data to identify, characterize, and quantify users (generators) of MCDs. Consequently, in order to assess the likelihood that MCD-only generators would be affected by the rule, the analysis estimated the number of MCDs a generator would have to dispose of to be classified as a SQG or LQG.

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[8] For example, under 49 CFR 173.64(c)(1), exceptions are provided for thermometers, switches, and relays that (1) each contain no more than 15 grams of mercury, (2) are installed as an "integral part" of a machine or apparatus, and (3) are fitted such that shocks from impacts are unlikely to cause leakages of mercury.

Further, based on the estimated lifetime of each MCD, the analysis estimates the number of devices that would need be *in use* at a facility. As discussed in more detail in Appendix A, MCD-only generators would have to use and discard very large numbers of MCDs to be classified as either SQGs or LQGs. As a result, this analysis assumes that all MCD-only generators are CESQGs.[9] Because CESQGs are exempt from the both Subtitle C baseline requirements and Universal Waste system requirements, these generators would not be affected by the inclusion of MCDs in the Universal Waste system and are thus excluded from this analysis.

3.1.2 MCD-Plus Generators

To identify the number of MCD-Plus generators (those that generated MCDs but qualify as SQGs or LQGs on the basis of other hazardous wastes), this analysis examined 1997 BRS treater data.[10] Specifically, data were extracted for all generators that send potential MCD waste to retorters known to accept MCDs. Waste was assumed likely to contain MCDs if (1) the waste code was mercury (D009) (only), (2) the form code was other waste inorganic solids (B319) or blank, and (3) the treatment code was retorting (M012), high temperature metal recovery (M011), other metal recovery for reuse (M014), or metal recovery- type unknown (M019). Based on information from a retorting facility (Mercury Waste Solutions) that 25 percent of the waste it handles is MCD waste, this analysis assumed 25 percent of potential MCD waste actually was MCD waste.[11] When available from BRS or the RCRAinfo database in Envirofacts (accessed in August 2001), SIC codes were obtained for each generating facility. Exhibit 3-1 summarizes of the number of generating facilities and average MCD quantities by two digit SIC code. Based on this analysis, 1,877 facilities generated over 550 tons of MCDs in 1997. The average annual quantity of MCDs generated at a single facility is approximately 590 pounds (0.295 tons).[12]

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[9] A discussion with one mercury retorter confirmed that there are no MCD-only generators. See Appendix B.

[10] BRS data are divided into generator data and treater data. Generator data are reported by LQGs only. Treater data include data on all shipments received by a treater, including shipments by CESQGs, SQGs and LQGs. Because both SQG and LQG shipments are of interest, the analysis used the treater data, rather than the generator data. This process may inadvertantly might inadvertently capture CESQG data.

[11] The results of this analysis are not particularly sensitive to this 25 percent estimate. See Section 9.

[12] As discussed in Section 9, the number of MCD-plus generators may be understated and the tons of MCDs may be overstated.

Exhibit 3-1. MCD-Plus Generators, Based on BRS Data

2 Digit SIC	Number of Generators	Average MCDs (tons)	Total MCDs (tons)
10	1	2.000	2.00
13	4	0.013	0.05
14	1	0.023	0.02
15	1	0.049	0.05
16	1	0.009	0.01
17	1	0.023	0.02
20	62	0.056	3.49
22	17	0.181	3.08
24	7	0.167	1.17
25	16	0.044	0.70
26	43	0.082	3.52
27	34	0.037	1.27
28	148	0.283	41.86
29	9	0.314	2.83
30	45	0.116	5.22
31	2	0.035	0.07
32	31	0.042	1.31
33	57	0.143	8.16
34	66	0.038	2.50
35	66	0.096	6.33
36	92	0.313	28.77
37	44	0.301	13.24
38	23	0.124	2.86
39	11	0.063	0.69
40	3	0.085	0.26
41	1	0.090	0.09
42	10	2.304	23.04
43	3	0.039	0.12
44	1	0.025	0.02
45	2	0.150	0.30
46	3	0.005	0.01
47	2	0.456	0.91
48	22	0.051	1.13
49	81	1.111	89.97
50	20	0.565	11.31
51	15	0.067	1.00
52	2	0.035	0.07
53	1	0.830	0.83

2 Digit SIC	Number of Generators	Average MCDs (tons)	Total MCDs (tons)
55	3	0.009	0.03
63	1	1.756	1.76
65	1	0.019	0.02
72	1	0.006	0.01
73	38	0.171	6.48
75	2	0.081	0.16
76	7	0.036	0.25
77	1	0.009	0.01
80	10	0.124	1.24
82	11	0.581	6.39
83	1	0.027	0.03
87	14	0.069	0.97
89	4	5.933	23.73
91	1	0.075	0.08
95	5	1.540	7.70
96	3	0.080	0.24
97	22	0.335	7.37
99	7	0.260	1.82
unknown	797	0.298	237.74
Total	1877	0.295	554.29

To determine whether each facility in the analysis is an LQG or SQG, this analysis assumes that MCDs make up between one and five percent of the generator's total waste.[13] Estimates of MCD quantities were divided by five percent to estimate total waste quantity for each facility. The analysis compared this estimate with 10 tons per year.[14] If a facility generated more than 10 tons of total waste per year, this analysis assumed it was an LQG. Otherwise, the facility was assumed to be an SQG. Using this methodology this analysis estimates that 131 of the 1877 generators were LQGs.

3.2 Number of Potentially Affected Handlers of MCDs

As discussed in Section 2.3 above, the Universal Waste regulations define two types of "handlers" of Universal Waste, SQHUWs and LQHUWs, which can be either generators or consolidation facilities. All generators in the baseline are considered handlers under Universal waste requirements. Consolidation facilities would include facilities that collect MCD waste and ship it to a retorter, and could operate within a company, serve as collection points for community collection efforts, or act as a waste broker. Due to uncertainty concerning the number of potential consolidation facilities that may be established, this analysis does not assume any new consolidation facilities will be established. However, any firm serving as a broker in the baseline would be considered a handler under the Universal Waste regulations.

These regulations allow a handler to accumulate waste for up to one year. The threshold accumulation amount that determines whether an entity is an SQHUW or an LQHUW is 5,000 kg at any one time. Assuming least-cost behavior, each SQHUW and LQHUW that generates post-consumer MCDs is assumed to make only one shipment to a TSDF (i.e., recycler) per year. Based on this assumption, only 13 of the 1,877 handlers will be LQHUWs. The remainder will be SQHUWs.[15]

3.3 Number of Potentially Affected Treaters of MCDs

To identify the number of treaters of MCD-plus waste, this analysis used 1997 BRS treater data. Data for all D009 (the hazardous waste code for mercury) waste using the retorting treatment code (M012) were extracted, and the names of the treaters were compiled. This generated a list of 18 facilities. Through a review of Internet sites for these 18 facilities, and limited contact with a few facilities, this analysis determined six firms with a total of ten facilities accepted MCDs in 1997 and still exist today. This research also indicated that there has been consolidation within the retorting industry (mergers, buyouts, etc) since 1997. It appears that at

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[13] A representative of Bethlehem Apparatus (a retorter) estimated that MCDs make up no more than one to five percent of a generators total waste.

[14] The actual LQG threshold quantity is 1000 kg/month (1.1 tons/month). Using 10 tons per year as the threshold assumes an LQG exceeds the threshold approximately nine months out of the year.

[15] CESQGs under RCRA also qualify as SQHUWs under the Universal Waste regulations. However, as specified in 40 CFR 273.5, CESQGs may choose to manage their universal wastes according to either the full RCRA requirements or the Universal Waste requirements. Given that CESQGs are subject to minimal waste management requirements under RCRA, this analysis assumes that all CESQGs continue to manage post-consumer MCDs under these requirements.

least two of these facilities (the National Environmental Services facilities) act as brokers rather than retorters. These two broker facilities would be considered TSDFs in the Subtitle C baseline and handlers in the Universal Waste system. The other retorters would be considered TSDFs in the baseline and destination facilities in the Universal Waste system. Exhibit 3-2 presents a list of these facilities from BRS.

Exhibit 3-2. MCD Retorters and Brokers

Manager ID	1997 Manager Name	Current Manager Name (if Different)
AZR000005454	Earth Protection Svc.	
FL0000207449	Recyclights, Inc.	National Environmental Services
FLD984262782	AERC/Mercury Technologies International	
MN0000903468	Recyclights, Inc.	National Environmental Services
NYD048148175	Mercury Refining Company, Inc.	Mercury Waste Solutions Inc
PA0000453084	Bethlehem Apparatus Co, Inc.	
PAD002390961	Bethlehem Apparatus Co, Inc.	
PAD987367216	AERC	
WID071164032	Superior Special Services, Inc.	
WIR000000356	Mercury Waste Solutions, Inc.	

3.3 Number of Potentially Affected Transporters of Discarded MCDs (Baseline and Universal Waste Requirements)

Data on the number of transporters shipping mercury wastes are not readily available. However, EPA has previously estimated that there are approximately 500 hazardous waste transporter companies in total (U.S. EPA, 1999). For lack of better data, this analysis assumes that 20 percent of these companies (i.e., 100 companies) currently ship post-consumer MCDs.

Under the Universal Waste regulations, transporters do not need to be certified hazardous waste transporters. Thus, any type of trucking company could potentially be a transporter of post-consumer MCDs. Based on data from the U.S. Bureau of the Census, the number of transporters of post-consumer MCDs under the Universal Waste requirements could be as high as 140,000.[16] This analysis assumes that 0.5 percent of these companies (i.e., 700 companies) will ship post-consumer MCDs under the Universal Waste requirements. Of these 700 transporters, 600 are assumed to be new entrants in the market for shipping post-consumer MCDs.

[16] This figure is derived from 1997 estimates for SIC codes 4210 (Trucking and courier services, except air) and 4730 (Freight transportation arrangement).

3.4 Disposal Price Research

MCD generators are known to dispose of their MCDs by sending them to retorters, to non-retorting TSDFs (along with their other hazardous waste), and to waste brokers.[17] This study contacted a small sample of such facilities in order to obtain information on prices charged for MCD disposal. The results of this research, summarized in Exhibit 3-5,[18] show relatively large variability in prices across retorters, non-retorting TSDFs, and waste brokers. Several possible factors might account for this variability:

- Pricing schemes may anticipate certain shipment sizes and therefore may not be directly comparable. For example, some firms may set prices on a per drum basis, while other firms might cater to smaller generators by charging on a per pound basis. Similarly, some brokers and non-retorting TSDFs may be able to receive volume discounts from retorters that are not obtainable by original MCD users.

- The prices may reflect a non-homogenous national marketplace that is heavily influenced by location and, therefore, by transportation costs. (There were only an estimated eight retorters operating in the U.S. in 1997.)

- The market may reflect imperfect information. That is, the price of alternative disposal destinations may not be widely known, either by generators or by waste brokers, retorters, and non-retorting TSDFs.[19] This possibility is also consistent with the fact that MCDs, despite their ubiquitous nature, are not recognized as MCDs by most people.

(These factors also might help explain the counterintuitive finding that prices charged by retorters are not consistently lower than those charged by brokers or by non-retorting TSDFs, both of which would be expected to pass along to their customers, with a mark-up, the prices charged by retorters. Another potential explanation could be that non-retorting TSDFs, in order to maintain a reputation for providing full-service hazardous waste management, may be willing to charge lower prices for MCDs given that relatively few MCDs are received from generators.)

The two key findings for this analysis are as follows: (1) the *amount* of MCDs to be disposed of is a key factor in evaluating relative disposal prices; and (2) given the significant variation in disposal prices, *other factors frequently predominate* over disposal costs in driving the decision of where to ship MCDs. In particular, it is worth noting that, because generators are likely to be sending other hazardous wastes to a non-retorting TSDF, least-cost behavior may be relatively complex and non-uniform. Other factors influencing the decision may include

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[17] Because these devices are ultimately destined for retorting, the term disposal may seem inappropriate. However, while the mercury is recovered at the retorter, the rest of the device is discarded.

[18] See also Appendix B.

[19] A mercury retorter representative stated that the firm does not publish price lists in order to protect the information from competitors.

geographic location and transportation costs, corporate contracts to handle other hazardous waste, convenience, and imperfect information.

Exhibit 3-3. Disposal Prices for MCDs

Facility Code	Facility Type	Unit Price(s)	Unit Price (volume Discount)	Volume Needed for Discount
A	TSDF (non-retorting)	$925/drum	NA	NA
B	TSDF (non-retorting)	$245 - up to 5 gallons $653 - up to 25 gallons $783 - up to 31 gallons $1002 - up to 55 gallons	$1,002/drum 1 drum	
C	TSDF (non-retorting)	$800/5-gallon pail >$2,000/drum		
D	Broker	$4.50 - $5.50/lb	$2,500/drum	drum price assumes 800 pounds
E	Retorter	$1,700/drum	$1,000/drum	NA
F	Retorter	$1,300/drum or $250 fee + $2 - $2.75/lb	$900/drum	50-60 drums/yr

3.5 Transportation Costs for Regulated Generators and Handlers

Under the baseline, transportation costs are those associated with certified hazardous waste transporters. Under the Universal Waste requirements, the analysis assumes that post-consumer MCDs will be packaged in manner that precludes them from being defined as hazardous substances under DOT regulations (i.e., with less than one pound of mercury per package).[20] As a result, transportation costs for non-hazardous materials were used for shipments under the Universal Waste requirements.

The transportation costs used in the model consist of two parts: (1) a fixed fee, and (2) a variable fee based on tons shipped and miles driven. The analysis assumes that generators are 200 miles from all types of recyclers (retorters, brokers, and non-retorting TSDFs). Exhibit 3-6 presents the fixed and variable costs to ship under Subtitle C requirements and under Universal Waste requirements. For both type of shipments, this analysis assumes the minimum quantity for which these equations is valid is one ton. Quantities lower than one ton have been rounded up to one ton.

[20] See Section 2.3 for a discussion of transportation requirements.

Exhibit 3-6
Transportation Costs for Post-Consumer MCDs Under the Baseline
(2001 dollars)

Type of Shipment	Transportation Costs*	
	Fixed	Variable** ($/ton-mile)
Hazardous Waste	$159	0.16
Universal Waste	$106	0.12

* Source: ICF (1998)
** The variable cost per ton-mile is valid for shipping distances between 50 and 400 miles. The analysis assumes an average shipping distance of 200 miles in the baseline.

3.6 Administrative Compliance Costs for Regulated Generators and Handlers

This section presents the administrative requirements and costs applicable to generators under the baseline and to handlers under the Universal Waste requirements. It is important to note the because all SQGs and LQGs that generate MCDs also generate other types of hazardous waste, not all of these costs will be affected for all entities.

Baseline Unit Costs: RCRA Subtitle C

The analysis models the current management of discarded post-consumer MCDs assuming 100 percent compliance with Subtitle C requirements.[21] Administrative activities required under Subtitle C and the associated unit costs are summarized in Exhibit 3-7. These unit costs were taken from prior EPA analyses on mercury-containing lamps and cathode ray tubes (ICF, 1999a; ICF, 1999b). In calculating total costs for generators in the baseline, the analysis assumes that SQGs and LQGs incur the low costs.

Universal Waste Requirements

Administrative activities required under the Universal Waste regulations and the associated unit costs are summarized in Exhibit 3-8. These unit costs also were taken from prior EPA analyses on mercury-containing lamps and cathode ray tubes (ICF, 1999a; ICF, 1999b). In calculating total costs for handlers under the Universal Waste requirements, the analysis assumes that the SQHUWs and LQHUWs incur the low costs.

[21] Appendix C presents an alternative scenario where some facilities are not in full compliance with Subtitle C requirements.

Exhibit 3-7
Administrative Unit Costs for Generators Under the Baseline (Full RCRA Subtitle C)
(2001 dollars)

Required Activity	Unit Costs			
	LQG		SQG	
	High Estimate	Low Estimate	High Estimate	Low Estimate
One-Time Costs*				
Notification of Hazardous Waste Activity	$161	$89	$161	$89
Rule Familiarization	$1,186	$356	$1,186	$139
Emergency Planning	$629	$230	$423	$124
Waste Characterization	$334	$0	$334	$0
Annual Costs				
Annual Review of Regulations	$67	$67	$67	$67
Subtitle C Recordkeeping	$35	$15	$35	$15
Biennial Reporting (annualized cost)	$387	$138	$0	$0
Personnel Safety Training (annualized cost)	$508	$223	$79	$31
Manifest Training	$175	$4	$37	$2
Variable Costs**				
Manifesting and Land Disposal Restriction Notification (per shipment)	$45	$33	$35	$32
Exception Reporting (per report)***	$69	$34	$32	$18

* One percent of the generators are assumed to be new facilities and thus they incur additional costs as startup facilities. This percentage was used to determine the number of establishments expected to incur initial costs in any year (one percent of the generator universe).

** Variable costs depend on the number of shipments made by a generator. The number of shipments per year was calculated and used to estimate the administrative costs.

*** The analysis assumes that no MCD manifests require an exception report.

Exhibit 3-8
Administrative Unit Costs for Handlers Under the Universal Waste Requirements
(2001 dollars)

Required Activity	Unit Costs			
	LQHUW		SQHUW	
	High Estimate	Low Estimate	High Estimate	Low Estimate
One-Time Costs*				
Notification of Hazardous Waste Activity	$161	$89	$0	$0
Rule Familiarization	$1,186	$177	$1,186	$89
Waste Characterization	$334	$0	$334	$0
Annual Costs				
Annual Review of Regulations	$33	$33	$33	$33
Personnel Safety Training (annualized cost)	$92	$28	$35	$10
Variable Costs**				
Shipping Recordkeeping (per shipment)	$9	$9	$0	$0

* One percent of the handlers are assumed to be new facilities and thus they incur additional costs as startup facilities. This percentage was used to determine the number of establishments expected to incur initial costs in any year (one percent of the handler universe).

** Variable costs depend on the number of shipments made by a large quantity handler. The number of shipments per year was calculated and used to estimate the administrative costs.

4. MCD Management Practices

This section discusses the baseline and post-rule options available to MCD generators, as well as a discussion of the factors influencing a generators selection of each option.

4.1 Baseline Practices

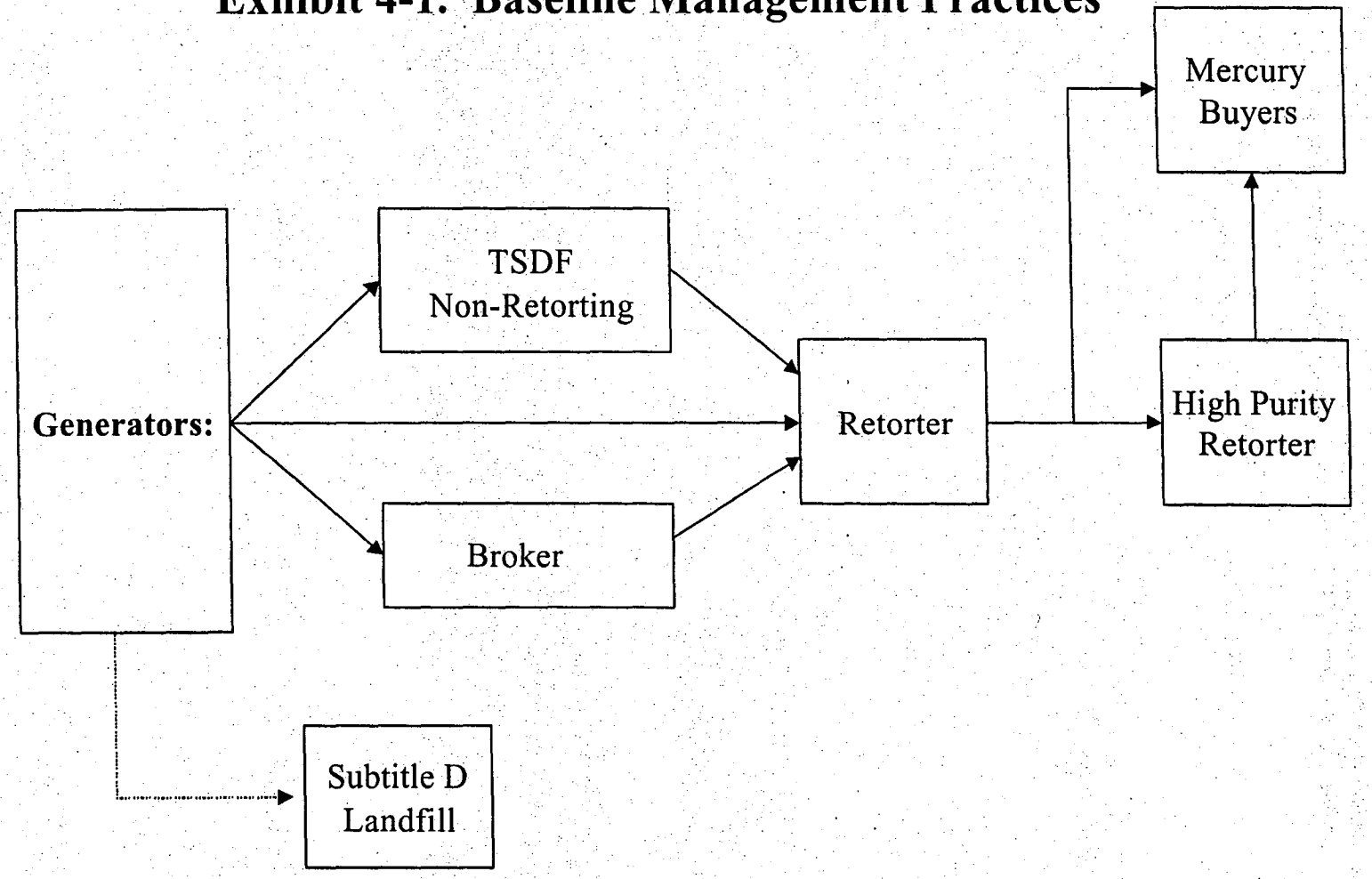
As shown in Exhibit 4-1, in the baseline MCD generators can send MCDs to a non-retorting TSDF (along with the other types of hazardous waste they generate), to the retorter directly, or to a broker.[22] The non-retorting TSDF and the broker would then have to send the MCDs on to a retorter. The retorter may then directly sell the mercury or send it on to a retorter that produces a higher purity mercury.

Based on the research conducted for this analysis, including conversations with industry representatives (see Appendix B) and analysis of BRS data, all of the pathways shown in the exhibit are used. The factors driving generators to select between a retorter, broker, or non-retorting TSDF include disposal prices and geography (i.e., actual distance from the generator to a particular disposal option), but the decision also is likely to be influenced by other factors. In fact, least-cost behavior may be relatively complex and non-uniform given that generators are

[22] In addition, it appears that some generators may be sending MCDs to MSW incinerators or landfills. Appendix C evaluates the impact of the rule on these generators.

likely to be sending other hazardous wastes to a non-retorting TSDF. For instance, by sending MCDs to the same non-retorting TSDF to which other waste from the facility is sent, a

Exhibit 4-1. Baseline Management Practices



generator might reduce manifest and shipping costs, and simplify facility operations. Alternatively, a generator might choose to send waste to a broker if the broker offers a substantially lower price on a small quantity of MCDs. Or, a generator might choose to send waste to a retorter directly if the retorter is located nearby or if the generator is already sending other waste to that retorter.

4.2 Post Rule Practices

In the post rule scenario, compliance costs will decrease for MCDs that are managed as a Universal Waste rather than as other Subtitle C hazardous waste. At a minimum, all MCDs shipped directly from generators[23] to waste brokers or retorters (i.e., to post-rule Universal Waste Handlers) will result in such savings, because management practices corresponding to current practices will cost less. For example, if a generator continues to ship MCDs to a retorter post-rule, then savings will accrue due to the reduced Universal Waste requirements. This is true regardless of the fact that the generator's other hazardous waste continues to be sent to a TSDF under full Subtitle C regulation.

Exhibit 4-2 summarizes the changes in a generator's transportation and administrative unit costs to send MCD waste to a broker or retorter post-rule while continuing to send other hazardous waste to a non-retorting TSDF. These costs assume that no new cost will be incurred for activities required under both regulatory schemes (e.g., notification of hazardous waste activity, safety training). For a generator sending less than one ton per year in a single baseline shipment, the savings would be $34. If the generator sent the same amount in two baseline shipments, but only one post-rule shipment, the savings would be $225.

MCDs that continue to be shipped from generators to non-retorting TSDFs post-rule, however, probably will not result in any savings. Recall that, in the baseline, some generators ship MCDs to non-retorting TSDFs along with their other hazardous wastes. Post-rule, such generators must continue to ship hazardous waste to the TSDF under full Subtitle C regulation, thereby eliminating most of the opportunity for regulatory savings. Even though the generator's MCDs could be sent to the TSDF as a Universal Waste, doing so would require the generator and the TSDF to operate under both the Universal Waste requirements and under full Subtitle C regulation. This is likely to be more expensive than simply sending the small amount of MCDs as if it were regular hazardous waste.

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[23] These generators include facilities such as waste brokers and non-retorting TSDFs to the extent that they originated shipments/manifests in the baseline.

Exhibit 4-2. Unit Cost Changes for Generators Sending MCDs to a Broker or Retorter in the Post Rule Scenario

New Universal Waste Costs	Eliminated Subtitle C Costs
Universal Waste Rule Familiarization: $89 (one time)*	
Annual Review of Regulations: $33	
Shipping Recordkeeping: $ 9 per shipment (LQHUW only)	Manifest Cost: $32 per shipment
Transportation Costs: $106 + $0.12/ton-mile**	Transportation Costs: $159 + $0.16/ton-mile**

* Rule familiarization = $26 when annualized over 4 years at a 7 percent discount rate.
** A 200 mile shipping distance is assumed regardless of destination. Shipment sizes are rounded up to next full ton.

Theoretically, greater savings might result from the rule if MCDs that had been shipped from generators to non-retorting TSDFs in the baseline were, post-rule, shipped to waste brokers or retorters. However, in reality, any savings would be minimal. For example, consider a generator that in the baseline is sending one drum of MCDs along with four tons of hazardous waste to a non-retorting TSDF twice a year; there is essentially no baseline manifest cost (the manifest must be completed regardless of the MCDs) and only a negligible baseline transportation cost (the truck is needed regardless of the MCDs). Post-rule, there is an additional $189 in new costs,[24] that must be more than offset by any savings in disposal costs (i.e., the generator would have to save more than $189 in disposal costs for such a switch to be economical).

5. Cost Results

This section describes how the incremental compliance costs of the proposed rule are calculated, assuming 100 percent compliance with all applicable requirements. The incremental annual cost savings attributable to the proposed rule (i.e., under the Universal Waste system) are calculated by subtracting the new costs under the Universal Waste requirements from the eliminated costs under the baseline.

[24] This $189 is the sum of $26 (the annualized cost to become familiar with the Universal Waste regulations), $33 (the annual cost to review regulations), and $130 (cost to transport one ton 200 miles).

5.1 Methodology

The analysis estimates savings as applicable for entities that will incur reduced costs as a result of the rule. The methodology does not assume any shifts in the flow of MCDs (i.e., in the percentage distribution of MCDs from original users to retorters, waste brokers, and non-retorting TSDFs) as a result of the rule because such shifts seem unlikely (as discussed in Section 4).

Costs to Generators

To calculate the savings to MCD generators (SQHUW and LQHUW under the Universal Waste System)[25] sending waste to a broker or retorter, this analysis used the following data from the BRS analysis as discussed in Sections 3.1.2 and 3.2: two- and four-digit SIC codes, assumed annual MCD generation rate, status as an LQG or SQG in the baseline, and status as an LQHUW or SQHUW in the post rule scenario. This analysis first calculated the number of shipments in the baseline based on LQG or SQG status: For LQGs, the baseline number of shipments was the greater of four or the annual waste quantity divided by 20 tons per truckload. For SQGs, the number of shipments was the smaller of two or the number of waste streams reported in BRS. The post rule number of shipments was calculated as the greater of one per year or the annual waste quantity divided by 20 tons per truckload.

This analysis then calculated the average shipment size by dividing the annual MCD generation rate by the number of shipments in the baseline and post-rule scenarios. The incremental unit costs from Exhibit 4-2 were then applied to each facility to calculate the new and eliminated costs for each facility. The eliminated costs were then subtracted from the new costs to calculate the savings for each facility.

Costs to Retorters and Brokers

For the most part, retorter and brokers[26] of universal wastes must comply with the same requirements that apply to recyclers of hazardous wastes. However, universal waste retorters and brokers are not required to comply with the manifest requirements under full RCRA Subtitle C, and instead are required only to keep basic records of shipments received. As a result, MCD retorters and brokers will realize cost savings under the Universal Waste requirements.

In the baseline, retorter and brokers are assumed to incur a cost of $36 per shipment for manifest recordkeeping. This unit cost estimate is calculated by taking the average across the unit costs for manifest recordkeeping that apply to SQGs and LQGs. Under the Universal Waste requirements, retorters and brokers are assumed to incur a cost of $9 per shipment for

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[25] These generators include original generators and brokers and non-retorting TSDFs that ship MCDs to retorting facilities.

[26] Brokers both send and receive waste. The costs of sending wastes are captured in the costs for generators as discussed above. The costs of receiving waste are described in this subsection.

basic recordkeeping. This unit cost estimate is calculated by taking the average across the unit costs for recordkeeping that apply to LQHUWs.

Thus the cost saving for recyclers was calculated by multiplying $36 by the number of shipments in the baseline (2,497), and subtracting the product of $9 multiplied by the number of shipments in the post rule scenario (1,885).

5.2 Cost Results

The total savings associated with the rule is $273,000. Of this total, $200,000 is estimated to accrue to MCD generators, with an average savings of $106 per generator. The remaining $73,000 in savings accrues to retorters and waste brokers. Exhibit 5-1 presents the average savings for a typical facility within each two-digit SIC code known to be affected based on BRS data.

Exhibit 5-1. Average Cost Savings per Facility (by SIC Code)

2-digit SIC	Number of Facilities	Average Savings	Total Savings
10	1	$678.73	$678.73
13	4	$33.73	$134.91
14	1	$33.73	$33.73
15	1	$33.73	$33.73
16	1	$33.73	$33.73
17	1	$33.73	$33.73
20	62	$69.31	$4,297.09
22	17	$86.20	$1,465.36
24	7	$129.30	$905.09
25	16	$61.60	$985.64
26	43	$106.33	$4,572.27
27	34	$73.08	$2,484.72
28	148	$125.51	$18,575.65
29	9	$152.28	$1,370.54
30	45	$97.62	$4,392.72
31	2	$33.73	$67.45
32	31	$62.50	$1,937.54
33	57	$90.73	$5,171.45
34	66	$54.00	$3,564.00
35	66	$87.29	$5,761.00
36	92	$134.89	$ 12,409.92
37	44	$118.18	$5,200.02
38	23	$120.99	$2,782.73
39	11	$74.27	$ 817.00
40	3	$108.06	$ 324.18

2-digit SIC	Number of Facilities	Average Savings	Total Savings
41	1	$33.73	$33.73
42	10	$294.03	$2,940.34
43	3	$182.39	$ 547.18
44	1	$33.73	$33.73
45	2	$256.73	$ 513.45
46	3	$33.73	$ 101.18
47	2	$368.23	$ 736.45
48	22	$33.73	$ 742.00
49	81	$261.63	$ 21,191.99
50	20	$241.18	$4,823.54
51	15	$48.59	$ 728.91
52	2	$33.73	$67.45
53	1	$702.73	$ 702.73
55	3	$33.73	$ 101.18
63	1	$678.73	$ 678.73
65	1	$33.73	$33.73
72	1	$33.73	$33.73
73	38	$80.89	$3,073.63
75	2	$145.23	$ 290.45
76	7	$65.58	$ 459.09
77	1	$33.73	$33.73
80	10	$145.23	$1,452.27
82	11	$156.09	$1,717.00
83	1	$33.73	$33.73
87	14	$65.58	$ 918.18
89	4	$381.48	$1,525.93
91	1	$33.73	$33.73
95	5	$544.93	$2,724.64
96	3	$33.73	$ 101.18
97	22	$ 169.77	$3,735.00
99	7	$ 285.16	$1,996.09
unknown	797	$87.36	$ 69,627.62
Total	1877	$ 106.43	$199,765.25

6. Economic Impact Results

The analysis estimates first-order economic impacts of incremental costs by calculating an industry average cost-to-sales ratio and cost-to-profit ratio for entities in two-digit SIC codes known to be affected by the rule, based on BRS data. Census data for the year 1997 served as the source of average sales data for establishments in each two-digit SIC code. Profits data

were obtained for those two-digit SIC codes containing the most affected entities.[27] Incremental compliance costs or savings for representative establishments were estimated as described previously.

The impacts analysis based on costs/sales is likely to overstate economic impacts (whether costs or savings) because the sales data used in the analysis represent average values for each SIC code as a whole, whereas the estimated compliance costs arise only for the entities that are large enough to be considered an SQG or LQG in the baseline. Such entities may have an average sales value that is slightly higher than the average for the industry as a whole. Conversely, the profits analysis is likely to understate economic impacts because profits data are estimated based on data for publicly held companies, which tend to be relatively larger than other companies and to have higher nominal profits. Given that the proposed rule will result in savings, rather than costs, neither of these limitations are significant. However, the combined effect is to make impacts appear more significant when measured as a percent of sales than as a percent of profit.

Exhibit 6-1 shows the impacts of the cost savings (as a percentage of sales) for the average affected entity in each two-digit SIC code. Cost as a percentage of sales is very small for all SICs (e.g., relative to the average savings per generator of $106 per year). The highest impact for a classifiable industry sector is on the "transportation services" sector (SIC code 47). Establishments in SIC code 47 have average annual sales of $800,280. The incremental savings represents 0.05 percent of the average annual sales.

Exhibit 6-2 shows the impacts of the cost savings (as a percentage of profits) for the average affected entity in the two-digit SIC codes containing the most affected entities. Cost as a percentage of profit is very small for all SICs. The highest impact for a classifiable industry sector is on the "electric, gas, and sanitary services" sector (SIC code 49), which contains TSDFs and electric and gas utilities, which are known to use relatively significant quantities of MCDs. Establishments in SIC code 49 have modeled average annual profits of $5,247,531. The incremental savings represents 0.005 percent of the average annual sales.

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[27] Two-digit SIC codes containing fewer than five affected facilities were excluded from the profits analysis. Profits data were available only at the four-digit SIC level based on data for selected publicly held companies. The analysis modeled profit at the two-digit SIC level based on the associated four-digit SIC code containing the most affected entities. Alternative four-digit SICs were selected as necessary where the summary data represented relatively few publicly held companies. Several relevant two-digit SIC codes were not modeled due to data limitations. Source: DIALOG Media General 2001, accessed August 2001.

Exhibit 6-1: Estimated Impact (Cost/Sales)

Industry	SIC Code	Average Sales (per establishment)	Affected Facilities	Savings as Percent of Sales
MINING				
Metal Mining	10	$15,444,022	1	0.004%
Oil and Gas Extraction	13	$7,099,539	4	0.0005%
Nonmetallic minerals, except fuels	14	$3,067,481	1	0.001%
CONSTRUCTION				
General Building Contractors	15	$1,918,732	1	0.002%
Heavy construction other than buildings construction- contractors	16	$3,651,692	1	0.001%
Construction- special trade contractors	17	$869,084	1	0.004%
MANUFACTURING				
Food and kindred products	20	$23,452,928	62	0.0003%
Textile mill products	22	$13,459,297	17	0.001%
Lumber and wood products	24	$3,164,898	7	0.004%
Furniture and fixtures	25	$5,300,519	16	0.001%
Paper and allied products	26	$25,534,243	43	0.000%
Printing and publishing	27	$3,512,951	34	0.002%
Chemicals and allied products	28	$31,829,039	148	0.0004%
Petroleum and coal products	29	$77,749,139	9	0.0002%
Rubber and misc plastics products	30	$9,900,988	45	0.001%
Leather and leather products	31	$5,645,731	2	0.001%
Stone, clay, and glass products	32	$5,484,777	31	0.001%
Primary metal industries	33	$29,069,529	57	0.0003%
Fabricated metal industries	34	$6,304,917	66	0.001%
Industrial machinery and equipment	35	$7,649,689	66	0.001%
Electronic and electric equipment	36	$20,102,162	92	0.001%
Transportation equipment	37	$42,369,196	44	0.0003%
Instruments and related products	38	$13,732,146	23	0.001%
Miscellaneous manufacturing industries	39	$2,988,227	11	0.002%
TRANSPORTATION, COMMUNICATIONS, AND UTILITIES				
Railroad Transportation	40	NA	3	NA
Local and interurban passenger transportation	41	$1,000,929	1	0.003%
Motor freight transportation and warehousing	42	$1,554,880	10	0.02%
U.S. Postal Service	43	NA	3	NA
Water transportation	44	$3,886,447	1	0.001%
Transportation by air	45	$13,768,621	2	0.002%
Pipelines, except natural gas	46	$8,642,919	3	0.0004%
Transportation services	47	$800,280	2	0.05%
Communications	48	$8,007,019	22	0.0004%
Electric, gas, and sanitary services	49	$21,082,044	81	0.001%
WHOLESALE TRADE				
Wholesale trade- durable goods	50	$7,179,142	20	0.003%
Wholesale trade- nondurable goods	51	$10,953,407	15	0.0004%

Industry	SIC Code	Average Sales (per establishment)	Affected Facilities	Savings as Percent of Sales
RETAIL TRADE				
Building materials, hardware, garden supply, and mobile home dealers	52	$2,332,525	2	0.001%
General merchandise stores	53	$9,835,465	1	0.007%
Automotive dealers and gasoline service stations	55	$4,169,625	3	0.001%
FINANCIAL, INSURANCE, AND REAL ESTATE INDUSTRIES				
Security and commodity brokers, dealers, exchanges, and services	63	$25,071,924	1	0.003%
Real Estate	65	$799,821	1	0.004%
SERVICE INDUSTRIES				
Personal services	72	$277,326	1	0.01%
Business services	73	$1,407,270	38	0.006%
Automotive repair, services, and parking	75	$566,325	2	0.03%
Misc repair services	76	$611,188	7	0.01%
Health services	80	$1,747,423	10	0.008%
Educational services	82	$2,920,852	11	0.005%
Social services	83	$616,590	1	0.005%
Engineering, accounting, research, management, and related services	87	$1,182,153	14	0.006%
Services, not elsewhere classified	89	$1,234,760	4	0.03%
PUBLIC ADMINISTRATION				
Executive, legislative, and general government	91	NA	1	NA
Environmental quality and housing	95	NA	5	NA
Administration of economic programs	96	NA	3	NA
National security and international affairs	97	NA	22	NA
Nonclassifiable Establishments	99	$85,596	7	0.3%

Exhibit 6-2: Estimated Impact (Cost/Profit)

Industry	SIC Code	Affected Entities	"Model" 4 Digit SIC	Average Profit (pre-tax)	Savings as a Percent of Profit
MANUFACTURING					
Food and kindred products	20	62	2086	$537,317,489	0.00001%
Furniture and fixtures	25	16	2511	$62,090,151	0.0001%
Paper and allied products	26	43	2621	$465,125,659	0.00002%
Printing and publishing	27	34	2752	$37,154,933	0.0002%
Chemicals and allied products	28	148	2821	$291,631,063	0.00004%
Petroleum and coal products	29	9	2911	$3,433,070,006	0.000004%
Rubber and misc plastics products	30	45	3011	$64,959,888	0.0002%
Stone, clay, and glass products	32	31	3241	$488,914,002	0.00001%
Primary metal industries	33	57	3312	$41,447,275	0.0002%
Industrial machinery and equipment	35	66	3585	$117,416,497	0.00005%
Electronic and electric equipment	36	92	3679	$8,174,795	0.002%
Transportation equipment	37	44	3714	$174,385,355	0.00007%
Instruments and related products	38	23	3841	$52,688,738	0.0002%
Miscellaneous manufacturing industries	39	11	3999	$37,205,970	0.0002%
TRANSPORTATION, COMMUNICATIONS, AND UTILITIES					
Motor freight transportation and warehousing	42	10	4213	$36,927,454	0.0008%
Communications	48	22	4813	$818,495,404	0.000004%
Electric, gas, and sanitary services	49	81	4953	$5,247,531	0.005%
WHOLESALE TRADE					
Wholesale trade- durable goods	50	20	5013	$103,109,313	0.0002%
SERVICE INDUSTRIES					
Health services	80	10	8062	$212,556,327	0.00007%
Educational services	82	11	8221	$16,638,061	0.0009%

Effect of Market Structure

Given the extremely low magnitude of the savings per facility that will result from this rule, the effects of market structure of affected industry sectors are insignificant to the incidence of the proposed rule's economic impacts.

Regulatory Flexibility

The Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement and Fairness Act, 5 U.S.C. §§ 601-612, generally requires an agency to conduct a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small not-for-profit enterprises, and small governmental jurisdictions. This proposed rule does not have a significant impact on a substantial number of small entities because today's proposed rule

relieves regulatory burden for affected entities through reduced regulatory requirements. In addition, the Agency estimates that this proposed rule leads to an overall cost savings of approximately $270,000. Accordingly, EPA believes that the rule will not have a significant economic impact on a substantial number of small entities.

7. Qualitative Benefits

Including post-consumer MCDs in the Universal Waste system is expected to result in three major potential benefits: (1) increase in regulatory efficiency and improvement in the implementation of the hazardous waste program; (2) establishment of consolidation facilities; (3) increase in recycling by regulated and non-regulated entities; and (3) reduction in mercury emissions. This section discusses these three qualitative benefits.

Regulatory Efficiency and Improvement in the Implementation of the Hazardous Waste Program

Post-consumer MCDs are usually generated in small quantities by large numbers of generators at many commercial, industrial, and institutional locations. This factor makes regulation of these devices difficult for both generators and regulatory agencies. Including post-consumer MCDs in the Universal Waste system will allow regulated entities greater flexibility in dealing with these wastes (e.g., due to increased accumulation time limits and the potential for waste consolidation), which in turn will allow them to manage these wastes more efficiently and with greater regulatory compliance.

Adding post-consumer MCDs to the Universal Waste system will also provide clearer, more streamlined requirements for post-consumer MCDs, which may reduce problems associated with a lack of understanding of certain requirements. Under current RCRA Subtitle C regulations, generators, transporters, and TSDFs that handle post-consumer MCDs must spend a significant amount of time, money, and other resources following the RCRA hazardous waste requirements. If MCDs were included in the Universal Waste system, this administrative and logistical burden would be reduced, as discussed above in Section 4.2.

Finally, regulating post-consumer MCDs as universal wastes could potentially reduce identification problems associated with having some mercury-containing wastes, such as lamps and thermostats, included in the Universal Waste system while others are not. Under current RCRA requirements, generators and other waste handlers may have problems identifying which mercury-containing wastes can be managed according to the Universal Waste requirements, which may lead to improper disposal (e.g., in a MSW landfill). Including other MCDs in the Universal Waste system could help to reduce this confusion.

Establishment of Consolidation Facilities

Research on the regulated community for post-consumer MCDs did not yield information on the potential number of entities that serve as consolidation facilities for these devices (other than brokers or non-retorting TSDFs). EPA's prior analyses of mercury-containing lamps indicates that recyclers generally have lamps shipped directly to their facilities and do not offer substantial discounts on larger volumes of lamps (ICF, 1999b). If this is also the case for MCDs, one would not expect to find a substantial number of consolidation facilities under either the current RCRA baseline or the Universal Waste requirements.

However, a petition filed by USWAG requesting that MCDs be added to the Universal Waste System suggested the rule would reduce the burden associated with managing small quantities of waste generated at remote and sometimes unstaffed locations such as electric substations and along gas distribution lines. Essentially, by including MCDs as a Universal Waste, utilities could collect wastes from remote locations and bring them back to their main facilities, which would function as consolidation facilities. These consolidation facilities would be considered Handlers of Universal Waste rather than TSDFs. As a result, full RCRA permitting as a TSDF would not be required for the facility.

In addition, this same ability to consolidate waste without becoming a permitted TSDF may apply to two other types of facilities. First, some manufacturers of MCDs or manufacturers of products that contain MCDs (e.g., gas ranges) may serve as consolidation facilities to receive discarded MCDs from their customers and from other generators.[28] Second, some generators such as hospitals may establish product swaps (e.g., trade-ins of mercury thermometers for digital thermometers) to promote responsible handling of discarded MCDs. Due to uncertainty concerning the number of potential consolidation facilities that may be established, this analysis does not model costs or cost savings associated with these facilities.

Increase in Recycling by Regulated and Non-Regulated Entities

One of the primary goals of RCRA is to conserve valuable material and energy resources. Shifting post-consumer MCDs from the RCRA hazardous waste system to the Universal Waste system should increase resource conservation by encouraging recovery of mercury from discarded MCDs.

Including post-consumer MCDs in the Universal Waste system will permit regulated entities (including those that are not in full compliance with hazardous waste requirements) to accumulate the devices they generate (or send the devices to consolidation facilities) for future shipment to an off-site recycling facility. Allowing facilities to accumulate larger quantities of MCDs could make recycling a more cost-effective option due to economies of scale. An increase in the demand for recycling of post-consumer MCDs might then encourage the recycling industry to develop and expand its operations, which in turn could make recycling a more attractive option for the regulated and non-regulated communities. Thus, both non-compliant generators and some non-regulated entities may shift their disposal of post-consumer MCDs from landfills or incinerators to recyclers. In addition, manufactures of MCDs may be further encouraged to establish reverse distribution networks for discarded devices to assist both regulated and non-regulated generators in recycling discarded MCDs.

Reduction in Mercury Emissions

More recycling of MCDs should occur as a result of including MCDs in the Universal Waste system. Recycling decreases the amount of mercury emissions that result from landfill and incineration disposal because it diverts waste from disposal. Mercury in recycled MCDs is separated, distilled, and recovered, rather than released to the air via incineration or landfilling.

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[28] According to 1997 data from the U.S. Bureau of the Census, there are approximately 16,000 establishments that manufacture MCDs or products containing MCDs.

The disposal of post-consumer MCDs in landfills and incinerators often results in mercury emissions to air, water, and other media. Mercury emissions are a serious problem because of the volatility of this metal: one gram of mercury (the amount usually found in a household thermometer) can foul up to 5 million gallons of water.[29] Due to the volatility of mercury and the fragility of many MCDs, mercury vapor is readily released into the environment when waste containing MCDs is managed improperly.[30] Mercury emissions are particularly detrimental because they pollute both air and water. Most mercury pollution to water is the result of mercury deposition from air into watersheds.[31]

8. Discussion of Findings

The primary conclusion drawn from the analysis is that the total cost savings of the rule and the average savings per affected entity are very small. Total savings, which are estimated to be $273,000 per year, appear particularly small when compared to the $70 million annual savings estimated for the original Universal Waste rulemaking, which covered nickel cadmium and other batteries, certain hazardous waste pesticides, and mercury-containing thermostats.

Both the RCRA Subtitle C baseline and the Universal Waste requirements modeled in this analysis assume that almost 1,900 entities will be affected if post-consumer MCDs are included in the Universal Waste system. Almost 75 percent of the $273,000 annual savings from this action will accrue to existing generators of these devices, with the remaining savings going to MCD retorters or brokers. Relative to the Subtitle C baseline, the economic impacts on the entities in the regulated community are expected to be negligible because the rule provides savings for all affected entities.

9. Assumptions, Limitations, and Sensitivity Analyses

The accuracy of the analysis depends on a wide variety of data and assumptions. The following is a list of key assumptions, limitations, and other factors affecting the accuracy of the analysis. Some assumptions tend to increase or decrease the savings of the alternatives, as noted below. Except where noted, assumptions are best estimates and are not believed to introduce systematic bias into the results.

- When analyzing the BRS data, this analysis assumes 25 percent of potential MCD waste is actually MCD waste (See Section 3.1.2). This estimate is based on information from a single retorter and may not be true across all retorters that accept MCD waste. In fact, some retorters may specialize in some type of devices (like flourescent light recyclers) and handle relatively little MCD waste. As a sensitivity analysis, the savings of the rule were also calculated assuming 12.5 percent and 50 percent figures. In both cases, the savings of the rule are essentially unchanged at $273,000.

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[29] Amber Bollman, Boston Globe, Nov. 16

[30] http://www.dep.state.fl.us/dwm/programs/mercury/lamps/htm

[31] http://www.state.ma.us/dep/files/mercury/hgch3b.htm#background

- Most of the incremental costs in this analysis are fixed per facility, rather than variable per shipment. As a result, the number of regulated facilities generating MCDs is a more significant variable in calculating savings associated with this rule than are the quantities of MCDs per facility. Because the number of facilities was derived from BRS data, it is believed to be the best estimate available and should be accurate given the assumptions of full compliance with Subtitle C regulations.

- To some extent, this analysis may undercount the number of regulated generators of MCDs, because the BRS data used do not capture all generators that send MCDs to a non-retorting TSDF. Specifically, of the 1,877 generators identified in this analysis, approximately 36 appear to be non-retorting TSDFs (based on a four-digit SIC code of either 4953 or 8999.) These 36 facilities generated an estimated 94 tons of MCDs in 1997. All of the original generators of these MCDS are not captured in the analysis, resulting in a potential to have underestimated the number of generators. However, because these original generators are not assumed to shift management to sending waste directly to a retorter or broker (see Section 4.2), these generators would not incur any costs or savings as a result of this rule. Hence, this analysis may undercount the number of regulated generators, but it does not undercount the number of affected regulated generators.

- Finally, the estimate of generators and quantities of MCDs may be slightly overstated if CESQGs send MCDs to retorters and are captured by BRS. To minimize this effect, obvious CESQGs (e.g., facilities with identification numbers like PACESGQ) were removed from the data set. Thus, it is unlikely that the effect of any CESQGs being captured in the analysis is significant.

- As described in Section 3.1.2, MCDs are assumed to comprise five percent of a facility's total waste stream. This assumption is used to calculate whether a facility is an LQG or SQG. In reality, the amount of MCDs may not be systematically related to total waste generation rates. The facility classification of LQG or SQG is subsequently used to calculate the number of baseline shipments. If the number of LQGs is overestimated, the overall savings of the rule would be slightly overstated.

- As described in Section 3.1.2, SIC codes could be identified for slightly more than half the facilities. Thus, the economic impact analysis does not address all affected entities.

- The impacts analysis based on costs/sales is likely to overstate economic impacts (whether costs or savings) because the sales data used in the analysis represent average values for each SIC code as a whole, whereas the estimated compliance costs arise only for the entities that are large enough to be considered an SQG or LQG in the baseline. Such entities may have an average sales value that is slightly higher than the average for the industry as a whole. Conversely, the profits analysis is likely to understate economic impacts because

profits data are estimated based on data for publicly held companies, which tend to be relatively larger than other companies and to have higher nominal profits. Given that the proposed rule will result in savings, rather than costs, neither of these limitations are significant. However, the combined effect is to make impacts appear more significant when measured as a percent of sales than as a percent of profit.

- This analysis assumes average device weights and lifetime for varying classes of MCDs to calculate the number of devices needed to be an SQG or LQG (as discussed in Appendix A). These assumptions are not likely to impact the finding that MCD-only generators are likely to be CESQGs.

- The assumed distance for transportation is 200 miles regardless of type of generator or recycler (non-retorting TSDF, broker, or retorter). In reality, the distance to one type of recycler may be significantly higher for a particular generator. Because no shift in management has been modeled, the distance to recyclers will be the same in the baseline and post rule scenario, and this assumption is not a significant factor in the analysis.

- All MCDs shipped under the Universal Waste requirements are assumed to qualify as non-hazardous materials. This assumption was made based on the fact that most MCDs contain relatively small (i.e., less than 10 grams) amounts of mercury (see Exhibit 2-1). The analysis assumes that discarded MCDs will be packaged in manner that precludes them from being defined as hazardous substances under DOT regulations. For shipments of post-consumer MCDs that are subject to the DOT hazardous materials requirements, the transportation cost savings calculated in the analysis would decrease.

- This analysis assumes full Subtitle C compliance in the baseline. This assumption understates the potential savings of the rule.

Appendix A: MCD-Only Generators

Preliminary research conducted for this analysis yielded insufficient data to identify, characterize, and quantify users (generators) of MCDs. Consequently, in order to assess the likelihood that MCD-only generators would be affected by the rule, the analysis estimated the number of MCDs a generator would have to dispose of to be classified as a SQG or LQG.

Through Internet research and limited contacts with vendors and manufacturers, this analysis obtained data on "typical" weights of several different kinds of MCDs. When unable to obtain weights for certain types of MCDs, this analysis calculated MCD weights using a ratio of mercury content to device weight for similar devices. This analysis then divided the SQG and LQG thresholds (100 kg/month and 1,000 kg/month) by the device weights to calculate the number of devices that an MCD-only generator would need to dispose of in order to be a SQG or an LQG. Exhibit A-1 presents the number of devices an MCD-only generator would need to dispose of in one month to be an SQG or LQG. For example, to be an SQG, a facility would need to dispose of over 12,000 veterinary thermometers during one month. Further, based on the estimated lifetime of each MCD, Exhibit A-2 presents the number of devices that would need be *in use* at a facility if all discarded MCDs were disposed of on an annual basis, or in equal amounts on a quarterly or monthly basis to be an SQG or LQG.

As can be seen in Exhibit A-2, MCD-only generators would have to use and discard very large numbers of MCDs to be classified as SQGs or LQGs. As a result, this analysis assumes that all MCD-only generators are CESQGs.[32] Because CESQGs are exempt from the both Subtitle C baseline requirements and Universal Waste system requirements, these generators would not be affected by the inclusion of MCDs in the Universal Waste system and are thus excluded from this analysis.

Exhibit A-1.
MCDs Required to be Disposed of to be Small or Large Quantity Generator

Device Category	Reported Mercury Content (grams per device)	Weight of device (grams)	Number of Devices Needed to be Disposed in one month to be classified as: SQG	LQG
Thermometers	2 ("typical")1	3.3	30,303	303,030
	0.5 (fever - low)2	0.83	120,482	1,204,819
	0.61 (fever - high)	1.01	99,010	990,099
	2.25 (basal temperature)	3.74	26,738	267,380
	3 (lab - low)	4.98	20,080	200,803
	10 (lab - high)	16.61	6,020	60,205
	5 (veterinary)	8.3	12,048	120,482
	5.56 (industrial - low)	9.24	10,823	108,225
	19.78 (industrial - high)	32.86	3,043	30,432
	3.5 ("typical")	5.81	17,212	172,117

[32] A representative from Bethlehem Apparatus confirmed that there are no MCD-only generators.

Device Category	Reported Mercury Content (grams per device)	Weight of device (grams)	Number of Devices Needed to be Disposed in one month to be classified as: SQG	LQG
Switches	2.6 (silent light switch)	5.2	19,231	192,308
and Relays	3.5 - 3,600 (industrial switch)	7200	14	139
	1 (float switch) 3	142	704	7,042
	0.5 -1 (automotive light switch) 4	1	100,000	1,000,000
	2 (chest freezer light switch)	4	25,000	250,000
	2 (washing machine light switch)	4	25,000	250,000
	3 (anti-lock brake switch)	6	16,667	166,667
	1 - 2 (ride control system switch)	4	25,000	250,000
	0.14 - 3 (mercury reed relay)	6	16,667	166,667
	160 (displacement relay)	320	313	3,125
	2.5 (flame sensor)	5	20,000	200,000
Gauges and	330 (sphygmomanometer) 5	450	222	2,222
Meters	395 (barometer - 2 3/4" face) 6	159	629	6,289
	395 (barometer - 6" face)	1542	65	649
	340 (typical manometer) 7	907	110	1,103
	91,000 (large manometer) 8	566,990	0	2
Other Devices	170 (recoil suppressor)	340	294	2,941
	1,000 (dilator)	2000	50	500

Shaded Cells indicated known device weight
Other Device Weights were calculated based on known weights of similar devices and a ratio of mercury content.

1 The weights of the thermometer types listed were calculated using a ratio of amount of mercury to weight of device. The ratio was derived by obtaining the weight of a veterinary thermometer from the Colorado Serum Company (colorado-serum@colorado-serum.com), which is 8.3 g. This was then used to calculate the other thermometers.

2 MCDs denoted by low and high indicate that a range of mercury content was estimated.

3 The weight of a plastic float switch was estimated to be 5 oz by Dave Bornhorst at Gateway Supply Co.

4 The weight of an automotive light switch was derived by averaging estimates from two documents, one a letter from The New York State Department of Environmental Conservation's Division of Solid and Hazardous Materials, Region 9, regarding the development of an automotive switch collection program, and the other a spreadsheet originating from the Clean Car Campaign's initiative to remove mercury switches from automotives, titled A Method for Estimating Mercury in Recalled Ford Vehicles. The ratio of estimated mercury content (~0.5 g) to the estimated device weight (~1 g) was used to calculate the remaining switches, except for float switches.

5 The weight of a sphygmomanometer was estimated at 1 lb by Richard Najarian at Bruce Medical Supply (brucemedi@aol.com).

6 The weights of brass barometers with 2 3/4" and 6" faces were estimated to be 0.35 lbs and 3.4 lbs, respectively, by Calvin Smith at Red Sky At Night (info@redskyatnight.com).

7 A typical manometer containing 12 oz of mercury is estimated to weigh 2 lbs by Erica Thurner at Dwyer Instruments, Inc. (Tech@dwyer-inst.com).

8 The weight of a large manometer was estimated to be between 1,000 and 1,500 pounds (~1,250 lbs) based on the model 1025LX manometer manufactured by Schwien Engineering, Inc. (See www.schwien.com/specs.htm)

Exhibit A-2. MCDs Required to be in Use to be Small or Large Quantity Generator

Device Category	Reported Mercury Content (grams per device)	Estimated or Assumed Device Lifetime (years)	Number of devices needed to be in use per facility, when disposed of		Number of devices needed to be in use per facility, when disposed of		Number of devices needed to be in use per facility, when disposed of on	
			SQG	LQG	SQG	LQG	SQG	LQG
Thermometers	2 ("typical")	5	151,515	1,515,152	606,061	6,060,606	1,818,182	18,181,818
	0.5 (fever - low)	5	602,410	6,024,096	2,409,639	24,096,386	7,228,916	72,289,157
	0.61 (fever - high)	5	495,050	4,950,495	1,980,198	19,801,980	5,940,594	59,405,941
	2.25 (basal temperature)	5	133,690	1,336,898	534,759	5,347,594	1,604,278	16,042,781
	3 (lab - low)	5	100,402	1,004,016	401,606	4,016,064	1,204,819	12,048,193
	10 (lab - high)	5	30,102	301,023	120,409	1,204,094	361,228	3,612,282
	5 (veterinary)	2	24,096	240,964	96,386	963,855	289,157	2,891,566
	5.56 (industrial - low)	5	54,113	541,126	216,450	2,164,502	649,351	6,493,506
	19.78 (industrial - high)	5	15,216	152,161	60,864	608,643	182,593	1,825,928
	3.5 ("typical")	5	86,059	860,585	344,234	3,442,341	1,032,702	10,327,022
Switches and Relays	2.6 (silent light switch)	50	961,538	9,615,385	3,846,154	38,461,538	11,538,462	115,384,615
	3.5 - 3,600 (industrial switch)	20	278	2,778	1,111	11,111	3,333	33,333
	1 (float switch)	20	14,085	140,845	56,338	563,380	169,014	1,690,141
	0.5 -1 (automotive light switch)	20	2,000,000	20,000,000	8,000,000	80,000,000	24,000,000	240,000,000
	2 (chest freezer light switch)	20	500,000	5,000,000	2,000,000	20,000,000	6,000,000	60,000,000
	2 (washing machine light switch)	20	500,000	5,000,000	2,000,000	20,000,000	6,000,000	60,000,000
	3 (anti-lock brake switch)	20	333,333	3,333,333	1,333,333	13,333,333	4,000,000	40,000,000
	1 - 2 (ride control system switch)	20	500,000	5,000,000	2,000,000	20,000,000	6,000,000	60,000,000
	0.14 - 3 (mercury reed relay)	20	333,333	3,333,333	1,333,333	13,333,333	4,000,000	40,000,000
	160 (displacement relay)	20	6,250	62,500	25,000	250,000	75,000	750,000
	2.5 (flame sensor)	20	400,000	4,000,000	1,600,000	16,000,000	4,800,000	48,000,000
Gauges and Meters	330 (sphygmomanometer)	4	889	8,889	3,556	35,556	10,667	106,667
	395 (barometer - 2 3/4" face)	4	2,516	25,157	10,063	100,629	30,189	301,887
	395 (barometer - 6" face)	4	259	2,594	1,038	10,376	3,113	31,128
	340 (typical manometer)	4	441	4,410	1,764	17,641	5,292	52,922
	91,000 (large manometer)	4	1	7	3	28	8	85
Other Devices	170 (recoil suppressor)	4	1,176	11,765	4,706	47,059	14,118	141,176
	1,000 (dilator)	4	200	2,000	800	8,000	2,400	24,000

Appendix B: Phone Logs

Bethlehem Apparatus, Inc.
890 Front St., P.O. Box Y
Hellertown, PA 18055

Date: August 16, 2001
Contact: John Boyle
Contact made by: Yvonne Stone

Bethlehem Apparatus

Bethlehem Apparatus is the largest commercial mercury recycling facility in North America. It accepts all types of mercury waste from free-flowing liquid mercury to mercury containing devices to mercury contaminated soil. Bethlehem is a global supplier of prime virgin and high purity mercury.

Procedures

- Profiling: All mercury is profiled before it is accepted. (Website)
- Waste Separation: MCDs do not typically arrive with universal waste, but this is due to shipping requirements, not company policies. A client with a broken manometer, which spilled and contaminated other materials may send a drum with the broken manometer, the directly contaminated material, the material contaminated in the process of cleaning up the spill, and a set of unbroken manometers the company decided to retire or replace. Bethlehem's price quotes are for generic mixed material.

Clients

- Composition: Bethlehem's clients run the gamut in terms of size and industry. Significant MCD client industries include brokers and utilities. Although Boyle guessed that more than half of MCDs arrive from brokers, he wrote off all further attempts to characterize the industry. "There is so little that is typical...there is no standard mercury generator." It appears that the reason it is so hard to characterize mercury generators is that the measuring devices and industrial equipment that make use of MCDs have such a wide range of applications in a wide range of fields. Thermometers and barometers may be used in households, research laboratories, health care facilities, or industry-each category of which has a different characteristic size, use pattern, and applicable regulatory code. Similarly, mercury tilt switches are the technology behind "silent switches" used in households as well as in heavy machinery which could be found in some capacity in almost any industry category or description. Any company with a boiler possesses a mercury containing device.
- Volume: If little can be said about a "typical" MCD generator, it appears that something can be said about the amount of MCDs handled and its volume relative to a generator's other waste. Boyle confirmed that no company becomes and SQG or LQG from mercury containing devices alone; mercury and/or MCD generation is typically a byproduct of a set of operations that generate some other waste, which gives a company SQG or LQG

generator status in the first place. Boyle estimates that MCDs probably account for around 1% to 5% of generator waste.

- Motivation for Disposal: Firms dispose of MCDs when they need to be replaced, not when new products become available. This means that there is no constant stream of MCD generation. Although there may be estimates of MCD lifespan, Boyle speculates that life depends on usage, and therefore varies significantly from case to case. Some companies collect and replace mercury products that they manufacture, resulting in a shipment of MCDs. This represents a rather small proportion of MCD shipments, but it has picked up lately as awareness of the hazards of mercury grows.

- Use of a Broker: Whether a firm goes through a broker depends on whether it already uses one for its other waste. If it does, it is likely to ask that broker to deal with its mercury waste also. If the firm is not otherwise involved with a broker, it tends to be cheaper to ship the mercury waste to the retorter direct.

Shipments

- Content: Bethlehem sees a wide variety of MCDs. Devices normally arrive post-consumer.

- Packaging: MCDs arrive in different containers depending the type of device and regulations applicable to the generator. Bethlehem sells reusable 76 and 2,250 lb. steel flasks, presumably for liquid mercury. Bethlehem offers a prepaid shipping container and retorting program, not only for lamps, but for thermometers, for use by CESQGs and households who need not ship MCDs under manifest. A thermometer shipping container holds up to 450 household thermometers.

Prices

- Disclosure: Price lists are given freely.

- Prices: Prices depend on the type of material and packaging. There is no standardization of prices and the range is large. A 55-gallon drum of mixed MCDs would be accepted for between $1,000 and $1,700 dollars. Some devices, such as water meters, require less labor to retort; these receive price discounts to as low as $400-$500 per 55-gallon drum.

Universal Waste Rule

In Boyle's opinion, a universal waste rule for MCDs would be wonderful. It would help a lot of people. Companies are currently hurt when they have just a very small quantity of MCDs and must ship this waste separately under manifest. Boyle described pick up services arriving at companies with a tractor trailer and then picking up a 2 Quart container, which the driver would drop off to the retorter from his cab. Boyle points out that thermostats can contain larger bulbs than thermometers, creating what generators see as an "illogical exclusion" of the latter from universal waste status.

Chemical Waste Management
Model City, NY
(716) 754-8231

Date: August 17, 2001
Contact: Jill Knickerbocker
Contact made by: Yvonne Stone

Chemical Waste Management (CWM)

Chemical Wastes Management is a TSDF that accepts MCD waste, which it ships on to a mercury retorter. Mercury transhipment makes up a very small proportion of its business. CWM currently receives just a couple of containers of MCDs a month. Knickerbocker speculates that if MCDs were no longer sent to her business, any effect would be negligible.

Procedures

Mercury containing devices may arrive mixed together, but may not be mixed with universal waste because of differing regulatory requirements for shipping. Mercury containing devices often arrive in a "lab pack" which contains all waste associated with a broken MCD (the broken device, materials contaminated by the device, materials used to clean up the spill). The lab pack is placed in a 55-gallon drum, which arrives at Chemical Waste Management and is shipped on to the retorter. Knickerbocker remarks that the retorter does not care if the waste is separated.

Clients

Mercury generally comes to Chemical Waste Management from labs, hospitals, or drug stores. Knickerbocker guesses that a number of hospitals would be LQGs, but that LQG status would not be due to MCD generation. On a very rare occasion, CWM would handle mercury switches from a broken machine sent by industry. CWM does not receive MCDs from demolition sites.

Pricing

The gate price for a 55-gallon drum of MCDs at Chemical Waste Management is $925. Knickerbocker did not have specific information about whether or at what price CWM would charge for MCDs by the pound but guessed that this could be an option for customers who had a small amount of MCD waste. She said that it was likely that clients with national accounts with Chem Waste would receive discounts of some sort, but that MCDs were such a rare item that she didn't know of specific examples. Similarly, Knickerbocker guessed that few discounts were given out for volume, not because it would not make economic sense, but because clients rarely have more than one or two drums to begin with.

Universal Waste Rule

Knickerbocker admits that she sees such small quantities of mercury coming to her company's facility that she assumes there is not much mercury in use out there. She suspects that a universal waste rule would help those involved, but that considering what she estimates to be the size of the industry, that number would be low.

Mercury Waste Solutions
302 North Riverfront Drive
Mankato, Minnesota 56001-3548
(800) 741-3343

Date: August 9, 2001
Contact: Scott Taylor
Contact made by: Yvonne Stone

Mercury Waste Solutions

Mercury Waste Solutions is one of only about six mercury retorters in the United States. Although MWS purifies some mercury on-site for resale to small firms or producers of dental amalgam, the majority of retorted mercury is shipped as scrap grade to D.F. Goldsmith, who purifies the mercury for resale. Taylor explains that MWS has not focused its efforts on sales, and so has a smaller network of buyers than D.F. Goldsmith, who is able to find demand to keep up with supply. Taylor guesses that MCDs make up at least 25% of the waste MWS receives.

Procedures

- Profiling: All waste is profiled before it is accepted. Waste that arrives that does not match specifications will still be accepted in most cases, but the customer will be charged a ~30% off-specification surcharge.

- Waste Separation: MWS separates waste according to regulatory status. If the client has only small amounts of two different types of MCDs, MWS will usually allow that client to ship them in the same 55-gallon drum. Similarly, if a small number of batteries, for example, were included in a shipment of MCDs, these would also be accepted without penalty. However, if a large amount of MCD and non-MCD objects arrive together in the same drum, the customer will be required to pay a surcharge to cover the costs of hand separation.

Clients

- Location: Clients come from throughout the lower 48 states, although MWS' business is strongest in the Midwest and Northeast, where the company has retorting facilities. Few clients come from the West Coast. Taylor explains that one reason why distant clients may choose MWS over a closer retorter is that not all retorting facilities are approved, narrowing retorter choices. A second reason is that the clients of some brokers request that MWS be used. Some large companies have corporate accounts with MWS, giving them access to more competitive pricing.

- Composition: Although MWS sees a wide variety of clients, the majority are waste brokering firms as opposed to individual generators. The generators who use their services tend to be large manufacturers in industries such as lighting (Sylvania, for

example), auto makers, and manufacturers of heavy machinery that make use of mercury switches.

Shipments

- Content: The size and type of devices sent varies.
- Packaging: Shipments arrive in 55-gallon drums. Drums are generally full since MWS prices per drum.
- Frequency: The number of shipments clients make vary considerably. MWS sees everything from SQGs and CESQGs clients, who may make only one shipment per year or one shipment ever, to large firms that may deliver 50-60 55-gallon drums per year.

Prices

- Disclosure: Prices were quoted freely.
- Prices: The price for accepting a 55-gallon drum of MCDs varies from $1300 for a single small shipment to $900 per drum for large corporate clients shipping 50-60 drums a year. The prices for mid-sized shipment falls between these figures, varying inversely with volume. There are about 10 or 12 price schedules for MCDs. One 55-gallon drum filled with MCDs weighs about 400 to 800 lbs. Sometimes drums run into DOT weight limits, and thus arrive only partially full. In general, however, drums arrive full since shipments are generally priced per container rather than by weight. MWS sometimes accommodate customers who would like their shipments priced per pound. The price per pound ranges from around $2.75 to $2 per pound, with a $250 dollar minimum per drum.

Universal Waste Rule Commentary

- Prepaid return program for MCDs: Taylor believes that a prepaid return program for MCDs, similar to MWS' Lamptracker program for florescent lights, would be both beneficial and feasible, given a universal waste rule for mercury containing devices. He does not foresee different MCD sizes as a barrier to such a program. Firms would be given 5-gallon (potentially 3-gallon) pails in which to collect and then ship MCDs.
- Effect on Recycling : Taylor believes that lowering transportation costs through a universal waste rule could increase the level of mercury recycling. He notes that for many small companies, transportation costs are currently prohibitive. A firm with only 5-10 lbs of mercury would have to pay about $300-$500 just for trucking.
- Effect on MWS: MWS currently operates at about 80 percent of capacity. An increase in the number of MCDs retorted would make a noticeable difference in MWS operations. MWS stores mercury waste by regulatory level, and so would have to make accommodations if the amount of universal waste coming in was much larger than usual. MWS does have options to address short-term influxes of products. On occasion, when the inflow of mercury at one plant exceeds capacity, the excess mercury is

transported to its other retorting facility. When inflow exceeds capacity at both plants, as happens during the seasonal variation of November and December (large manufacturers clear out their inventories for the start of the next year), the excess mercury products are stored for later processing when business slows (usually January).

MTI/AERC
West Melbourne, FL
(800) 808-4684

Date: August 7, 2001
Contact: Tracy DePaola
Date: August 9, 2001
Contact: Bob Blanchfield
Contact made by: Yvonne Stone

MTI/AERC

MTI/AERC is a mercury retorter and a member of the Association of Lighting and Mercury Recyclers (ALMR). MTI/AERC processes and then retorts the mercury it receives. For example, lamps are crushed and then the lamp powder processed [Blanchfield]. MTI/AERC accepts all types of MCDs.

Procedures

- Waste Separation: MCDs must arrive sorted by material composition. For example, two different devices both comprised of liquid mercury and glass could come shipped together, but neither device could arrive in the same package with batteries or a florescent light [DePaola].

Clients

- Composition: MTI/AERC sees a variety of contractors from small labs to demolition contractors and industrial sites. A large contract for the firm involves Becton-Dickenson, a thermometer manufacturer, who is pulling one quarter million of its thermometers out of circulation [Blanchfield].

- Noncompliance: Blanchfield believes that one of the large sources of noncompliance is property management. Although transportation costs are high, Blanchfield believes that noncompliance by property managers is driven by a desire not to enter the entire retorting process. They would rather "stick their heads in the sand." Blanchfield speculates that a scenario in which property managers would be brought into compliance would be partnership with a large firm whose business was already inextricably linked with regulation, such as a large pharmaceutical company. In this case, the partnering company would demand that its products be disposed of correctly for liability reasons.

Shipping

- Composition: Drums of MCDs often arrive with drums of other mercury waste. This is because there are almost never enough drums of MCDs to fill an entire truck when it comes time to transport mercury within the company. Trucks usually arrive full [Blanchfield].

Prices

- Prices: MTI/AERC does not generally give out price lists. Prices are not published to shield that information from competitors. To this end, prices are not given out to public studies [DePaola].

Universal Waste Rule

MTI/AERC was very involved with the creation of the universal waste rule for florescent lights, working with the EPA on the issue since 1993. MTI/AERC is interested in seeing a universal waste rule come out for MCDs [Blanchfield]. A universal waste rule would make mercury recycling more cost effective by lowering transportation costs [DePaola].

National Environmental Services (NES)
Minneapolis, MN
(952) 830-1348

Dates: August 7 and 28, 2001
Contact: Dale Borton
Contact made by: Yvonne Stone

National Environmental Services (NES)

National Environmental Services is a mercury broker with locations in Tampa, FL and Minneapolis, MN. It does not retort mercury. NES accepts all types of MCDs, which it ships immediately to one of two retorters depending on where the MCD waste originated. Waste that arrives from within Minnesota is sent to Superior at Fort Washington. Waste that arrives from out of state is sent to Lighting Resources' retorting facility in Phoenix, AZ. NES does not deal in mercury waste laced with any other type of contaminant. MCDs make up less than 10 percent of the mercury waste that NES receives.

Procedures

- Profiling: NES requires that all waste be profiled before it is brokered (and typically before price of service information is given out). Virtually all waste is shipped under manifest.
- Waste Separation: Devices must be separated by type to be accepted. It would be possible, however, to ship two different types of MCD in one 55-gallon drum as long as the devices were in separated by containers inside that drum.

Devices

- Size: The devices that NES receives most frequently are switches and barometers. While switches are quite small, a standard barometer measures three to four feet in length and measures about 15 lbs. Barometers are the largest MCDs that NES generally receives.
- Pre-processing: Many devices have broken down before they are sent to NES. In a typical scenario, a customer might have a jar of mercury or have a consolidated mercury from a collection of units, breaking off a glass part of a device from a mercury bead. Barometers typically cannot be broken down because they have a large, long bead of liquid mercury.

Clients

- Location: Clients come from throughout the lower 48 states.
- Composition: Most client companies have 250 or more employees.

- Noncompliance: While the typical MCD shipment that NES receives is a batch of switches, these switches very rarely come from demolition projects, leading Borton to believe that most demolition projects do not recycle. Similarly, NES sees very few small companies (<250 employees), which Borton believes reflects a status quo of non-compliance among these companies.

Shipping

- Size: Most MCD shipments consist of a couple of 55-gallon drums. A four drum shipment would be considered large and reach the threshold for receiving a discount.
- Packaging: Most devices, whether large or small, are packaged in 55-gallon drums. Borton notes that 55-gallon drums appear to be the industry standard. NES does often provide special containers for waste disposal.
- Frequency: The size and number of shipments varies by client industry and generator status (CESQG, SQG, LQG). Barometers generally come to NES one or two at a time. The average number of MCD shipments in a year is around two.

Prices

- Disclosure: NES avoids giving price lists; it wants to know about the waste it is dealing with before giving quotes. Borton emphasizes that the company must operate according to strict regulations. Presumably NES does not want to enter a situation in which a client is quoted a low standard price, further information reveals new necessary procedures that raise costs, and the client is displeased.
- Prices: Transhipment of MCD waste is usually billed by the pound. The average cost for accepting a pound of MCDs is about $5.50. Large shipments (about four 55-gallon drums) could be discounted as much as a dollar to $4.50 per pound. Borton describes mercury brokering as a "volume driven industry." As the volume of waste brokered through NES rises, prices for each type of waste fall. For example, if a company shipped 2,000 florescent lamps to NES along with a drum of MCDs, the drum of MCDs would be priced at a discount. NES passes along a lot of the low prices it receives from retorters for shipping making many shipments a year. For a good customer with an 800 lb drum of MCDs, NES said they might charge $2,500 (~$3.13/lb).

Universal Waste Proposal

- Prepaid return program for MCDs: Borton believes that MCDs could be "an easy fit" for a prepaid return program like the Green Kit program NES has in place for florescent lamps.
- Effect on Mercury Recycling: Anything that brings down transportation and/or administrative costs could make recycling more accessible and bring more firms into compliance with disposal regulations. Borton notes that 100 devices is a lot for a smaller firm to generate in a year. A firm in Texas with a couple of switches probably does not comply today, but could be likely to comply in the future, given lower transportation costs.

- Effect on NES: A universal waste rule would also be advantageous to NES since it would allow NES to store MCDs before shipping them, raising the volume of MCDs per shipment and lowering both shipping and disposal costs. In both transportation and retorting, prices fall as quantity rises. Borton predicts that NES savings would be reflected in the price of their services. Competition between brokers would drive prices down.

Onyx Environmental Services
1 Eden Lane
Flanders , NJ 07836
(973) 347-7111

Date: August 30, 2001
Contact: Sales Department
Contact made by: Yvonne Stone

Onyx Environmental Services

Onyx Environmental Services is the new name for Waste Management, Inc. The company is a national waste brokering and disposal facility. Onyx Environmental Services, formerly Waste Management, Inc., owns Chemical Waste Management and Rust International. (See http://www.greenlink.org/grassroots/soc/wastenot/97i02799.html). Some facilities appear to still operate under the name Waste Management, Inc., for example the facility at Port Arthur, Tx, Phone: (409) 736-2821. Company services include: landfill, stabilization, solidification, macro encapsulation, and drum bulking for transshipment. The company accepts MCD waste. In addition to transshipment, the company can be hired to package and transport mercury waste from the client facility (Information at: http://www.chwmeg.org/asp/search/detail.asp?ID=18).

Prices

Onyx has a very wide range of prices. In addition to waste volume, type of mercury containing device and client location are significant variables in what Onyx charges for MCD disposal. The New Jersey facility alone handles 10 different territories, each with its own price schedule. Although prices vary tremendously, the sales department was able to provide ballpark figures. Disposal costs for 5 gallons of MCD waste through their company, not including transportation costs to their facility or the cost of packaging, will cost around $800 to $900. To dispose of a 55-gallon drum of MCDs, a customer will pay over $2,000.

Clients

It may be noted that the sales department first offered the 5-gallon price when asked for price schedule information (the full drum price was offered in response to a specific question). Although this may not be significant, it may be indicative of the scale of typical MCD shipments received. (The contact was not asked follow up questions as she specifically stated that information requests not from non-clients were low priority and that she was pressed for time.)

Safety-Kleen Corporation
Salt Lake City, UT
(801) 323-8100

Date: August 30, 2001
Contact: Sherm Monson
Contact made by: Yvonne Stone

Safety-Kleen Corporation

Safety-Kleen, also known as Laidlaw, is a TSDF that offers Incineration, landfill, hazardous liquids (acid) broker and transfer services (Information at: http://www.chwmeg.org/asp/search/detail.asp?ID=3). It is a broker for MCD waste, all of which it ships to Superior at Fort Washington.

Procedures

- Waste Separation: Different types of MCDs may arrive packaged together, but they may not be mixed with items such as lamps or batteries that are subject to a different set of regulations.
- Transshipment: MCD waste received from clients is consolidated, but not repackaged. Safety-Kleen stores the MCDs waste at its facilities until it has enough for a full load, at which time it remanifests the waste and ships it to its retorter.

Prices

Safety-Kleen has one price list for all clients, regardless of location and/or type of MCD. Its price list, based on MCD waste volume, is as follows:

1-5 gallons	$245
6-25 gallons	$653
26-30 gallons	$783
31-55 gallons	$1,002
More than one 55 gallon drum	$1,002 per drum

Safety-Kleen does not offer further discounts for frequent customers or extra large shipment volumes. Safety-Kleen does not offer customers the option of pricing per pound.

U.S. Geological Survey
Reston, VA,
(703) 648-4981

Date: July 31, 2001
Contact: Robert Reese
Contact made by: Yvonne Stone

The Market for Mercury

- Price: The price of mercury has followed a downward trend. Mercury now sells for around $150/ton.
- Import/Export: As to why the amount exported and imported varies so considerably, Reese speculated that the observed import/export patterns may arise from firms taking advantage of opportunities in foreign exchange markets, changes in buyer/seller prices, or other economic circumstances of the firm. The mercury shipped abroad is not qualitatively different from that imported into the United States.
- Future: The amount of mercury used in products is falling in all industries. Retorters would have a hard time selling more mercury. The market for mercury is a "dead horse."

Universal Waste Rule

Reese was not familiar with universal waste regulations or with changes over time in the market for recycling batteries and florescent lamps. Even if shipping costs were significantly reduced, there would be little incentive for new consolidation companies to arise to sell retorted mercury.

Appendix C: Subtitle D Baseline Analysis

The main analysis in this document assumes full baseline compliance with Subtitle C regulations for all SQGs and LQGs. This appendix evaluates an alternative baseline that assumes some Subtitle D disposal of MCDs both before and, to a lesser extent, after the rule.

The first step is to estimate the percent of the regulated universe disposing of MCDs as MSW. This is equivalent to asking "what percent of the LQG and SQG universe is out of compliance with the Subtitle C regulations in the baseline?" Neither a literature review or phone interviews with selected individuals involved in mercury recycling and disposal suggested a noncompliance rate, although one vendor indicated that his firm does not receive switches from demolition contractors, suggesting that mercury switches generated during demolition may commonly be disposed of as MSW. In the absence of further information, this analysis assumes that half of the universe is out of compliance. Because the universe in the main analysis is based on BRS data (i.e., data on generators known to comply with Subtitle C regulations), this analysis assumes that LQGs and SQGs disposing of MCDs as MSW are in addition to the 1,877 generators identified in the main analysis.

The second step is to determine if any portion of generators disposing of MCDs as MSW will change management practices as a result of the rule. This analysis assumes there are two major reasons for noncompliance: (1) cost, and (2) ignorance that waste contains MCDs or that MCDs should be disposed of as Subtitle C waste. As seen in the main analysis, the savings associated with the rule for a generator are small, estimated at just over $100 per facility. Given the relative magnitude of the disposal costs ($1,000 to $2,500 per drum), this savings is not likely to motivate noncompliant generators to change their management practices. In addition, the rule does not provide for any major public awareness campaigns about MCDs, and is not likely to inform generators that their devices are hazardous. However, mercury retorters and brokers may attempt to raise public awareness of the new regulatory status of MCDs, at least to their customers who may be sending mercury lamps or mercury thermostats for disposal. Consequently, this analysis assumes that a small percentage (five percent) of the generators incorrectly disposing of MCDs as MSW will change their management practices. As a result, approximately 94 additional generators will manage MCDs as a Universal Waste in the post rule scenario.

The third step is to estimate the cost or savings for these additional 94 generators. The cost of a generator moving from Subtitle D management to Universal Waste management include (1) new transportation costs, (2) new disposal costs, and (3) additional administrative costs. Baseline transportation and disposal costs for the 94 generators are assumed to be essentially zero, as the generators were previously disposing of MCDs as MSW, and the quantities of MCDs are small. In other words, the relative baseline disposal cost of throwing a few devices in with the facility's normal MSW is negligible. Therefore, assuming a MCD quantity of less than one ton per year, the annual transportation and administrative cost will be $189. (See Section 4.2 for more information on the derivation of this cost.) The disposal cost will increase from essentially zero to approximately $1,500 (the average retorting cost for one drum from Exhibit 3-3). section the average for a single drum at Bethlehem Apparatus and Mercury Waste Solutions). The total of these costs ($1,689) pre facility per year is multiplied by the 94 generators assumed to switch management practices to result in a total new cost of $158,766.

Subtracting this cost from the $273,000 savings estimated in Section 5.2 results in a total savings under the Subtitle D baseline of approximately $114,000.

The preceding result considers the added cost to generators of managing MCDs according to the Universal Waste regulations as opposed to the considerably less expensive Subtitle D regulations. An alternative view would be to consider the rule as reducing the cost of compliance for these facilities because these generators would incur the relatively less expensive costs of Universal Waste regulations instead of the somewhat higher cost of full Subtitle C regulations. If the rule is viewed as creating savings because these generators would spend less to come into compliance, the savings can be calculated by multiplying the average facility savings calculated in the main analysis ($106/generator) by the number of facilities likely to change management practices (94 facilities). The resulting savings is $9,964 for these facilities. Adding in the $273,000 savings estimated in section 5.2 results in total savings under the Subtitle D baseline of approximately $283,000.

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