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D.E.R. SOUTH DISTRICT

September 1, 1992

Mr. Philip A. Barbaccia
Environmental Administrator
Program Administrator
Waste Management
Florida Department of Environmental Regulation (South District Office)
2295 Victoria Avenue
Suite 364
Ft. Myers, Florida 33901

RE: Lee County Household Battery Management Program

Dear Mr. Barbaccia:

As a condition of certification for the Lee County Solid Waste Energy Recovery Facility District (Case No. PA90-30), Lee County is required to develop and implement a household battery management program. Mr. David M. Knowles, P.E., of your office requested information regarding the County's battery management program plans. Please be advised that a comprehensive battery management program has been developed by the Lee County Department of Utilities, Division of Solid Waste Management, and was implemented in May, 1992.

The County's battery management program consists of four types of programs geared towards major battery waste generator sources. The types of battery management programs instituted by Lee County Division of Solid Waste Management include the following:

- button cell battery drop-off programs,
- curbside household battery collection programs,
- hospital battery recovery programs, and
- school battery collection programs.

The "Supplemental BACT Analysis of Source Separation for Mercury Control at the Lee County Resource Recovery Facility Report", submitted to your office in June, 1992, provides a brief description of each of the battery programs listed above. A copy of this report has been enclosed for your reference (see pp. 9 through 12).

In addition, the Lee County Department of Utilities, Division of Solid Waste Management, has developed publicity and education materials for its battery management program. These materials are utilized to inform Lee County residents of the following:

- how to participate in the County's curbside battery collection program,
- the locations of the battery drop-off collection sites,

Philip A. Barbaccia
Florida Department of Environmental Regulation

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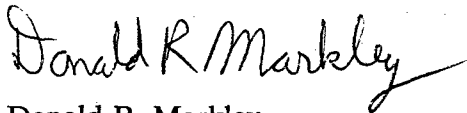
- which types of batteries are collected,
- why it is important to collect batteries, and
- where to call for additional information.

Sample publicity materials utilized as part of the County's battery management program are enclosed for your information.

If you have any questions or concerns regarding Lee County's battery management program, or require additional information, please do not hesitate to contact us.

Very truly yours,

MALCOLM PIRNIE, INC.



Donald R. Markley

Enclosures

- c: L. Sampson, Lee County Division of Solid Waste w/o encl.
P. Young, Ogden Martin Systems, Inc. of Lee County w/o encl.
J. Kowal, Ogden Martin Systems, Inc. of Lee County w/o encl.
D. Cerrato, Malcolm Pirnie, Inc. w/o encl.

**SUPPLEMENTAL BACT ANALYSIS
OF SOURCE SEPARATION
FOR MERCURY CONTROL
AT THE LEE COUNTY
RESOURCE RECOVERY FACILITY**

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1.0 INTRODUCTION

1.1 Purpose of Analysis

Lee County has prepared this report to supplement the information contained in its PSD air permit application and the County's power plant site certification application (see Volume III, Air Quality), in order to address issues raised in the February 28, 1992, United States Environmental Protection Agency (USEPA) Remand Order In the Matter of: Brooklyn Navy Yard Resource Recovery Facility (PSD Appeal No. 88-10, February 28, 1992). In that case, the USEPA Administrator remanded the applicant's PSD application to Region II "for the very limited purpose of considering the viability of reasonably available material separation programs to reduce the NO_x emissions from the Brooklyn facility" (Remand Order, p. 21). The Remand Order states that, "[A]lthough Region II must consider source separation as part of its BACT determination for NO_x, it does not follow that the Region must ultimately require source separation in this case" (p. 15). The critical issue raised by the Brooklyn Navy Yard Remand Order regarding NO_x emissions "is whether there is sufficient indication that a source separation program would reduce emissions beyond the levels achieved by the conventional control technologies already included in the permit" (p. 13).

Whether source separation is Best Available Control Technology (BACT) was also recently addressed by the U.S. Court of Appeals for the Ninth Circuit in Citizens for Clean Air v. EPA (CA 9, No. 90-70119, March 26, 1992) with regard to the Spokane, Washington municipal waste incinerator. The court found that although studies presented by citizen groups to the EPA supported the position that recycling should be considered in a BACT determination, the EPA was not in violation of the Clean Air Act when it approved a permit for the Spokane facility which did not require recycling as BACT. The court stated that the EPA had acted reasonably when it concluded that none of the studies presented by the citizen groups supported the position that, by requiring recycling, emissions of regulated pollutants would be reduced to lower levels than would otherwise be achieved by installing the air pollution control technologies already required by the PSD permit.

This report discusses the effect of source separation on the BACT determination for mercury made by Lee County in its applications for the Lee County resource recovery facility. A conventional BACT determination contains a detailed analysis of the environmental, energy and economic costs of the air pollution control system to be employed. In the case of source separation, the costs and benefits are not readily quantifiable. There is currently no available source of data and information which would

allow Lee County to accurately address the costs and benefits of its source separation battery collection program. Nevertheless, Lee County voluntarily implemented a comprehensive source separation program to capture batteries and other mercury-containing waste materials before they would be processed in the County's resource recovery facility. This report demonstrates that Lee County's existing source separation program, when combined with the County's plan to use state-of-the-art mercury control equipment, goes far beyond BACT requirements for mercury control.

1.2 Source Separation in BACT Determination

This report addresses the Lee County source separation program and its role in the BACT determination for mercury control at the proposed Lee County resource recovery facility. BACT is defined in the federal Clean Air Act regulations as an emissions limitation which would result in the maximum degree of pollutant reduction which is achievable after considering energy, environmental and economic impacts and other costs. Clean Air Act Section 169(3); 42 U.S.C. 7479(3); 40 CFR 52.21(b)(12) (1990). The emission limitation may be achieved by mechanical systems, treatment methods, or any other available method which is designed to control the emission of a pollutant. Source separation has never been imposed as BACT in a permit, but the Brooklyn Navy Yard case suggests that source separation may be considered as a control technology if it is demonstrated to be the best available control technology when the energy, environmental, economic impacts and other costs are considered.

Source separation is a method of recycling where residents separate garbage by type (e.g., paper, glass, aluminum, etc.) and either place the recyclables at curbside for separate collection or bring them to a drop-off facility. Once collected, the source separated materials can either be processed at a recycling center or can be taken directly to market for processing. Available data on recycling programs appear to indicate that source separation programs achieve higher participation rates and are more effective than those programs that do not include a component of source separation. The primary purpose of a source separation program is to divert solid waste materials which would otherwise be disposed of in a municipal solid waste landfill or resource recovery facility. Recycling can be accomplished by processing the material for another use or by reusing the material in the same manner for which it was originally designed and manufactured.

Resource recovery or "waste-to-energy" facilities typically process selected materials. Municipal waste combustion facilities require a combustible waste stream. Since metal

waste materials and metal components do not combust entirely, these facilities operate more efficiently when they do not accept such materials. In addition, these facilities do not accept hazardous waste and many types of construction and demolition waste that could result in processing inefficiencies. In many municipalities where resource recovery facilities are operating, recyclable materials are already diverted for recycling and other purposes. For example, recyclable materials such as aluminum, metal and glass are separately collected and do not reach the combustion process.

The Lee County resource recovery facility will operate in the same manner as other resource recovery facilities by combusting only a select waste stream which is defined in its Service Agreement with its Vendor. As defined in the Service Agreement:

"Processible Waste" means that portion of Solid Waste which can be Processed which is collected and disposed of as part of normal collections of Solid Waste in the County, such as, but not limited to: garbage, trash, rubbish, refuse, paper and cardboard, plastics, tin or other metal cans, beds, mattresses, sofas, bicycles, and other noncombustible residential waste mixed in Solid Waste, occasional automobile or small vehicle tires (to the extent the air emission criteria applicable to the Facility are not violated by the Processing thereof), as well as portions of commercial and industrial Solid Waste which can be Processed, trees and lumber, if no more than four (4) feet long and/or six (6) inches in diameter or width, branches, leaves, twigs, grass and plant cuttings; excepting, however, Nonprocessible Waste and Hazardous Waste. If any governmental agency or unit having appropriate jurisdiction shall determine that any wastes which are not included, as of the Contract Date, within this definition of Processible Waste because they are considered harmful, toxic or dangerous to public health and welfare, are not harmful, toxic or dangerous, then such wastes shall be Processible Waste for purposes of this Service Agreement, unless otherwise excluded under the definitions of Nonprocessible Waste or Hazardous Waste.

(Service Agreement between Ogden Martin Systems of Lee, Inc. and Lee County, Florida, Article II, Definitions, Section 2.01, pp. 22-23).

Therefore, the first step in controlling mercury emissions through source separation consists of two components. The initial component is the selection of a non-industrial waste stream, while the second part involves identifying and removing mercury-containing items prior to combustion.

2.0 OVERVIEW OF CURRENT LEE COUNTY SOURCE SEPARATION AND RECYCLING PROGRAM

Lee County has a well established recycling program with very high levels of participation. From July 1, 1990 through June 30, 1991, Lee County recycled approximately 18 percent of its total solid waste stream. This rate was achieved through the combined efforts of both the public and private sectors. Data available for the first three months of 1992 indicate that the County's recycling rate could exceed 25 percent in 1992. The County fully expects to achieve the Florida recycling goal of 30 percent by 1994. In fact, the Board of County Commissioners has established a recycling goal of 40 percent.

As of September 16, 1991 more than 100,000 single family homes were participating in the County's curbside source separation recycling program. This amount represents approximately 94 percent of all of the single family households in Lee County. The few single family homes which are not receiving curbside service are in lightly populated areas and have access to the County's drop-off collection program for their recyclables.

The County's successful curbside collection program works as follows:

- Recyclables are set out at the curbside in commingled recyclable containers;
- The County accepts tin and aluminum cans, plastics, all colors of glass containers, and newsprint;
- During the tourist season, the container set-out participation rates range from 25-70 percent;
- During the off season, the participation rate ranges from 15-70 percent;
- 99 percent of 2,000 households surveyed indicated that they recycled at least once a month; and,
- Residential recyclables are taken to the Lee County/Goodwill Materials Recycling Facility (MRF) for processing and are then shipped to market.

The success of the Lee County recycling program can be measured by the quantities of material recycled. From July 1, 1989 through July 1, 1990, the County recycled approximately 74,000 tons. This total has steadily increased to approximately 140,600 tons recycled in calendar year 1991. The Lee County/Goodwill MRF has grown in capacity along with the growth in recycling activities in the County. This facility began as a small 900 square foot building with a processing capacity of two tons per day (tpd). The MRF now

consists of a new 26,000 square foot complex with a design capacity of 200 tpd. In 1991, the Lee County Division of Solid Waste Management and Goodwill Industries of Southwest Florida were nominated by the EPA Region IV Administrator as finalists for the National EPA Administrator's Award for municipal solid waste management through recycling.

In addition, the County has already implemented management programs for handling special wastes, including batteries, household hazardous waste, used oil, land clearing debris, horticultural waste, white goods, waste tires, and certain medical wastes (i.e., needles used in syringes and other used sharps). In 1991, the County instituted a battery source separation program. The program was initiated through a drop-off system where residents could conveniently and safely deposit used batteries at pre-designated locations. In 1992, the County program was extended to include batteries as a source separated item where residents are able to place their waste household batteries (segregated into separate bags) along with their other recyclables at the curb for separate collection.

The Lee County recycling program is one of the most comprehensive recycling programs in the United States today. Although this report specifically addresses Lee County's program for the removal of mercury-containing wastes from its MSW stream, which is described in detail in Section 3.0, the following summarizes the County's efforts with household hazardous wastes (some of which contain mercury), lead-acid batteries, waste oil, land clearing debris, white goods, waste tires, and used sharps.

Household Hazardous Waste: A household hazardous waste transfer station has recently been constructed to provide County citizens with an environmentally sound method for disposing of household hazardous waste materials. This household hazardous waste collection facility was constructed with grant funds received from the State in 1990. The facility has been specifically designed for the collection and temporary storage of household hazardous waste (e.g., fencing and security). Quarterly drop-off dates, usually two-day events, are well advertised in local newspapers and on the radio. The County's licensed hazardous waste hauler (currently Laidlaw, Inc.) participates in these events and handles all the materials. At the conclusion of the drop off days, the household hazardous waste material is collected and the licensed hazardous waste hauler transports the material for proper management at a fully licensed facility. This is an effective program which helps the County remove mercury-containing wastes, such as paint cans, thermometers, thermostats, and barometers from its MSW stream.

Lead-Acid Battery Program: Lead-acid batteries (i.e., large, wet-cell batteries used for powering automobiles, boats, motorcycles and other machinery) found in the County's MSW stream are either dropped off by citizens or collected separately by the County and recycled for their lead content. Many of these batteries are dropped off by citizens at local automotive service stations. The County's mobile waste oil collection vehicle is also available to collect these batteries during its monthly collection rounds. In the fiscal year 1990/91, the County collected 926 lead-acid batteries, an average of about 77 per month. The collected lead-acid batteries are sold to several local vendors for recycling.

Mobile Waste Oil Collection: On a monthly basis, a mobile waste oil collection vehicle is dispatched to civic centers, shopping malls and school parking lots for the collection of waste oil. Drop off dates are advertised in the local newspapers and on posters in local retail stores and gas stations. During the fiscal year October 1, 1990 through September 30, 1991, approximately 4,800 gallons of waste oil had been collected. This program also provides the mobile collection vehicle to collect lead-acid (i.e., automobile, motorcycle, boat) batteries from the publicized sites.

Land Clearing Debris: A local recycling company, Forestry Resources, Inc. (FRI), collects yard waste, brush and land clearing debris from sites being cleared by developers in Lee County (as well as residences in Sanibel). The materials are brought to FRI's site for chipping, screening, and grading prior to its re-use as mulch and compost. FRI recycled 40,000 tons of commercial horticultural debris from land clearing activities within the County from July 1, 1990 through June 30, 1991.

Horticultural Waste: Lee County has a contract with Waste Management, Inc. (WMI), for the use of WMI's horticultural waste recycling center located at the Gulf Coast Landfill. This facility recycles the curbside-collected horticultural waste materials from residences, and is also made available to landscapers. Haulers collect the materials from Cape Coral, Ft. Myers and the seven franchised areas in the County. The haulers bring the material to WMI's Gulf Coast Landfill/Horticultural Recycling Center for processing into mulch and landfill cover material.

White Goods: White goods are separately collected by the County and delivered to Garden Street Iron & Metal, a local recycling company. The County's ongoing "right of way" clean-

up program also delivers white goods to Garden Street Iron & Metal. From July 1, 1990 through June 30, 1991, the County recycled 110 tons of white goods.

Waste Tires: Waste tires in Lee County are stockpiled, shredded and used as supplemental landfill cover material. The potential use of shredded waste tires as a roadway aggregate material is being investigated. The County recently received a \$209,000 State Waste Tire Grant to study alternative options for waste tire management.

Used Sharps: The County's used sharps depository program provides safe and easy-to-use "red box" containers for the collection of used needles from County's citizens and seasonal visitors. Convenient drop off centers have been established for these materials. A licensed biohazardous waste hauler (currently Browning-Ferris Industries) provides collection. The red boxes are collected regularly, on a monthly basis, whether full or partially empty. The boxes are currently hauled to a medical waste incinerator for proper disposal.

3.0 LEE COUNTY SOURCE SEPARATION PROGRAM FOR MERCURY

Mercury is present in the municipal solid waste (MSW) stream of virtually every community in the United States. The sources of mercury in MSW are primarily household (including cylindrical, button cell, and other shape) batteries, fluorescent light bulbs, paint pigments, thermometers and thermostats. Household batteries are by far the largest source of mercury in MSW, accounting for up to 88 percent of the total, according to the USEPA Office of Integrated Waste Management (Kearney/Franklin, 1991). Since household batteries contribute most of the mercury to the MSW stream, Lee County has taken a number of steps to provide for their proper management. The County has also taken steps to remove other sources of mercury from the MSW stream.

3.1 Description of Major Household Battery Types *

The two major types of consumer batteries used in the United States are: household batteries and lead-acid batteries. As suggested by their name, household batteries (includes cylindrical, button cell and other shapes) are employed mostly for household uses, such as in: flashlights, radios, toys, cameras, hearing aids, calculators, watches, and tools. Lead-acid (i.e., approximately 50% lead by weight, and containing approximately one gallon of sulfuric acid) batteries are used in automobiles, motorcycles, boats, lawnmowers and similar equipment. A brief description of each type of household battery is set forth below:

Mercury cells: Widely used in electrical appliances, these batteries can be either in button cell or cylindrical form. Their mercury content can be 35% by weight. The energy system consists of zinc/potassium/mercury oxide.

Cylindrical alkaline-manganese: Used to power flashlights, toys and similar items, these batteries usually contain about 7% mercury by weight. The energy system consists of zinc/potassium hydroxide/manganese dioxide. The mercury is used to control the tendency of the zinc negative electrode to react with other battery components to generate a gas which would greatly reduce the battery's efficiency and could also rupture the cell casing.

* The information contained in this section was obtained from The Solid Waste Dilemma: An Agenda for Action, USEPA, Office of Solid Waste, September 1988, Appendix A.F-1 - A.F-4.

Zinc-carbon: These are low-cost batteries which are used in portable electrical appliances. These batteries also are sold in both cylindrical and flat cell shapes. The energy system consists of zinc/ammonium chloride/manganese dioxide. These batteries may also contain a small amount of mercury to stabilize gas generation by zinc.

Silver-oxide: These button cell batteries can be found in over 30 different sizes and are used to power small electrical appliances such as watches. They also generally contain approximately one percent mercury by weight. The energy system can be either silver oxide/potassium hydroxide or sodium hydroxide/zinc.

Zinc-air: These are relatively new batteries used primarily for continuous discharge applications (e.g., hearing aids). The energy system is zinc/potassium hydroxide/oxygen, with the oxygen supplied by exposing holes in the battery casing to air (the holes can be sealed with removable foil).

Nickel-cadmium: These rechargeable batteries come in button, cylindrical and rectangular shapes. The energy system consists of cadmium hydroxide/potash lye/nickel hydroxide. Between 75 and 80 percent of the nickel-cadmium batteries sold are sealed within rechargeable appliances.

Lithium: These are very small batteries used to power watches, pocket calculators and computerized items. The energy system is a combination of lithium and a variety of other chemicals (e.g., manganese dioxide).

3.2 Conditions of Certification Related to Battery Source Separation

As previously mentioned, the County already has in place an effective household battery collection program. Although these programs already have been implemented, the conditions of certification for the Lee County resource recovery facility formally require the County to establish a household battery collection program and implement a recycling program for batteries. Specifically the conditions of certification state:

XIV. OPERATION

A. Air

3. Miscellaneous Requirements

f. Restriction for Type of Wastes Combusted

.... The County shall establish a household battery collection program to be specified by the applicant prior to start of construction, to further minimize mercury emissions. (pp. 14-15)

XXI. SOUTHWEST FLORIDA REGIONAL PLANNING COUNCIL

A. Waste Management

2. Lee County shall implement a battery recycling program. (p. 43)

3.3 Lee County Battery Source Separation Program

Lee County has initiated programs that continue to be expanded to maximize the removal of mercury from its MSW stream. The four major programs developed by the County thus far which are designed to remove mercury-containing batteries from its MSW are: button cell battery drop off locations, curbside household battery collection, hospital battery collection, and battery collection drives at public schools. Each of these programs is summarized below:

Button Cell Battery Drop Off: Non-lithium button cell batteries may be dropped off at 46 retail locations throughout the County (e.g., jewelry stores, camera/photo supply shops, and drug stores). According to County records, currently about one-half of the collected button cell batteries are returned to the manufacturers. The other half (primarily nickel-cadmium) is collected by the County for either recycling or proper disposal in a hazardous waste landfill.

Curbside Household Battery Collection: Beginning in May 1992, each household in the County has received four "orange bags" which are 3-mil. zip lock collection bags for household batteries, including button cell and cylindrical. When the household bag is full, the homeowner will place the orange bag at the curb next to the recycling bin for separate collection. The hauler will collect the bags and place them in a special container in the recycling truck. These separately collected bags will then be delivered to the Lee County/Goodwill Industries MRF for separate storage in 55 gallon drums. When a maximum

of 2,000 pounds has been accrued, the batteries will be shipped by a permitted hauler to a fully permitted hazardous waste landfill for proper management and disposal.

Hospital Battery Program: The County has sent a survey to hospitals, clinics, nursing homes and other health care centers to ascertain the number and kinds of mercury containing batteries being used and disposed of by these generators. The results of the survey will enable the County to develop a targeted program. As it develops, the program will also target thermometers and other mercury containing waste materials. The County will model its program after the highly successful Broward County (FL) program.

School Battery Collection: The County has sponsored battery collection contests in its public schools. Under this program, drop off containers for household batteries are located in each school to encourage and facilitate participation. This program was initiated as one of the events leading up to Earth Day, April 1991. During this program in 1991, 40,000 household batteries were collected in a three month period. The County is currently determining whether such programs should be repeated in the future.

3.4 Other Mercury Collection Programs**

Although household batteries account for up to 88 percent of the total mercury found in MSW, Lee County has provided for the proper management of other sources of mercury in its MSW. The County's continuing public education and awareness efforts and its household hazardous waste collection facility allow its residents to properly manage such wastes. In the EPA study, Characterization of Products Containing Mercury in Municipal Solid Waste in the United States, 1970 to 2000 (April 1992), the following MSW stream items containing mercury were identified:

Electric Lighting: Fluorescent lamps and high intensity discharge (HID) lamps. These lamps are often applied in floodlighting, sunlamps, insect lamps and photography uses. Mercury content in fluorescent and HID lamps varies with bulb size and wattage. Improvements in manufacturing process controls and design changes have reduced the mercury content of these lamps by about 25 percent over the last five years. The reported estimate of the average mercury content used was: for fluorescent lamps from 1970 to 1984,

** Information regarding mercury-containing MSW materials contained in this section was obtained from Characterization of Products Containing Mercury in Municipal Waste in the United States, 1970 to 2000, USEPA, Office of Solid Waste and Emergency Response, April 1992, p.p. 2-14 to 2-40.

approximately 75 mg, which has declined to 55 mg from 1985 to present; for HID lamps from 1970 to 1984, approximately 33 mg, which has declined to 25 mg from 1985 to present. Lee County has initiated a program for collection of mercury vapor bulbs from County-owned facilities (e.g., recreation facilities and municipal buildings). The collected bulbs are handled by the County's hazardous waste hauler. The County has considered and rejected other proposed programs for the separate collection of fluorescent bulbs. Among the reasons for rejecting such a program are the lack of a facility in North America which recycles mercury from fluorescent bulbs, and the fact that mercury usage in such bulbs is declining.

Paint Residues: Mercury-based biocides were for many years added to paints to preserve the paint while in the can by controlling microbial growth and to preserve the paint film from mildew after it had been applied to a surface. Since May 1991, all registrations of mercury biocides have been cancelled by the EPA. However, mercury from paint residue enters the MSW stream from old discarded paint cans. Lee County's effective household hazardous waste collection program targets old paint cans for drop-off at its household hazardous waste collection facility to prevent this source of mercury from entering the MSW.

Fever Thermometers (also known as "clinical mercury-in-glass thermometer"): These are standard oral, rectal and baby thermometers, which include an average weight of .61 grams of mercury. The prevalence of this type of thermometer is decreasing. The purchase of this type of thermometer is declining due to the increased use of digital thermometers by doctors, and the increasing popularity of color-changing fever indicators for in-home use. However, because of the higher cost of digital thermometers, it has been estimated that the mercury content of MSW caused by the standard fever thermometer will decrease gradually. The County has been cooperating with local hospitals regarding the management of mercury containing wastes such as thermometers and blood pressure gauges. Most of these hospitals have designed or are designing programs for the proper handling of mercury-containing waste found in the medical waste stream. In addition to its hospital battery program, Lee County will continue to use its public information and education program to target other mercury-containing wastes such as thermometers for proper collection and disposal. The County's household hazardous waste collection facility is equipped to collect and properly manage these materials to keep them from entering the MSW stream.

Residential Mercury Thermostats: These are electrical mercury devices used in the heating/cooling of homes. A telephone survey conducted by the EPA in July 1990 of heating and air conditioning system repair shops in the metropolitan Kansas City area disclosed that no special disposal or collection methods were being used for mercury thermostats. Honeywell, Inc., the leading supplier of home thermostats in the United States, has indicated that it uses mercury switches. Typical Honeywell mercury switches contain three (3) grams of mercury per bulb. According to Honeywell, about 70 percent of their home thermostats contained one mercury switch and 30 percent contain two to four switches (Kessler, 1992). The typical lifetime of such a thermostat is at least fifteen years.

Lee County has contacted commercial vendors of heating, ventilation and air conditioning (HVAC) systems in the area to request their assistance in the proper management (i.e., collection and proper disposal) of mercury containing thermostats. During March 1992, a waste mercury survey was sent to 233 HVAC and control system contractors in the County; 102 contractors responded. The number of thermostats disposed of by the responding contractors was reported to be between 5,300 and 5,600. Most of the devices disposed of were reported to be single mercury switches. Seventeen of the companies responding accounted for approximately 82 percent of the total number of devices disposed of (i.e., between 4,400 and 4,600 of the total of between 5,300 and 5,600). The County received a very positive response when it asked whether the contractors would be willing to remove the bulbs and store them separately for County collection. As a result of this survey, the County will initiate a source separation program for the 17 largest generators of these mercury- containing devices. The County's public education program will target the remaining contractors to inform them of proper management and disposal of the mercury bulbs.

Pigments: Various mercury compounds have been used as a colorant or pigment. For example, mercuric sulfide has been used in inks, rubber, elastomers and in artists' colors; mercuric oxide pigment has been used as an anti-fouling agent in marine paints, (this use was banned in 1971). Due to the downward trend in using any heavy metals in pigments, and the cessation of production of mercury-containing pigments in the United States in 1988, the presence of mercury in such pigments found in MSW is likely to continue to decline dramatically. Lee County will include such mercury-containing wastes in its household hazardous waste public education program and any MSW material containing

such mercury compounds will continue to be accepted at the County's household hazardous waste collection facility for proper disposal.

Dental Uses: Dental uses have accounted for two to four percent of total mercury usage in the United States since 1980. Dental fixtures used for tooth repair (e.g., cavities) are approximately 50 percent mercury by weight. According to the EPA, a maximum of ten percent of dental mercury enters the MSW from lost fillings, teeth with fillings, and amalgam material not collected by dentists. It is estimated that dental use of mercury will continue to decrease significantly due to more effective preventive dental care, the increasing use of plastics and ceramics as an alternative, and due to increased awareness of the environmental concerns associated with mercury use. Lee County will include dental offices in its public education and awareness program for health care centers which generate mercury-containing waste, as long as such offices continue to utilize mercury amalgams which may enter the MSW stream.

Mercury Electric Light Switches: These mercury electric light switches are used in homes and apartments and have a life expectancy of over 50 years. It has been estimated that the mercury in each switch weighs about 3.5 grams. Many of these switches will not end up in MSW, but rather in construction and demolition debris due to renovation or demolition work performed on the homes. As with the commercial HVAC contractors, Lee County will include home repair and construction companies in its public education and awareness program to advise them of the importance of proper management of mercury electric light switches, in order to divert these switches from the MSW stream.

Many of the aforementioned uses of mercury are declining or have ceased entirely. Among other discontinued uses of mercury are: as a mirror coating, as a modifier in glass manufacture, to improve felt quality, the use of mercury fungicides for textiles and fabrics with continuous outdoor uses, and as a slimicide in the production of paper. Despite the fact that products which previously contained quantities of mercury are now being manufactured without mercury, Lee County will continue to target mercury-containing wastes which remain in its MSW stream for proper collection and disposal as long as practicable and environmentally beneficial.

3.5 Funding and Costs of Source Separation Program

In the EPA document, Municipal Waste Combustion: Background Information for Materials Separation (January 1991), case studies are included of four United States municipalities with materials separation programs (pp. 3-1 to 3-56). These four municipalities represent a range of populations and geographic areas: Woodbury, New Jersey (population approximately 12,000); Islip, New York (population approximately 300,000); Seattle, Washington (population approximately 500,000); and, the State of Rhode Island (population approximately 1,000,000). These case studies include a discussion of the capital costs (e.g., includes collection equipment, trucks, trailers and facility construction), operation and maintenance (O&M) costs (e.g., includes collection and administrative labor, fuel/oil, truck maintenance and insurance), program revenues or credits (e.g., revenue from sale of recyclables and avoided disposal charges), and the net program cost (i.e., the difference between the annualized capital costs plus total O&M costs, and the sales revenues plus avoided disposal charges). The reported net program costs for the materials separation programs studied were: Woodbury - \$53,964 (1988); Seattle - \$1,397,614 (1988); Rhode Island - \$4,314,784 (1990); and, Islip - \$6,236,502 (1990).

Due to the lack of available data, Lee County (population approximately 380,000) is unable to perform a detailed evaluation of its source separation program specifically for mercury-containing wastes for inclusion in this analysis. The funding and costs of the County's source separation program for recyclables and household hazardous waste, as well as an analysis of the current revenues and costs of a battery recycling program are discussed in this section.

Lee County's source separation program for recyclables and household hazardous waste collection is currently funded by surcharges on each ton of solid waste disposed of at the County's landfill. These surcharges have increased each year since the beginning of the County's program. The following surcharges have been imposed:

<u>Fiscal Year</u>	<u>Recycling Surcharge</u>	<u>Household Hazardous Waste Surcharge</u>
89/90	\$3.85/ton	\$0.73/ton
90/91	\$6.00/ton	\$0.77/ton
91/92	\$7.28/ton	\$1.50/ton

As the County's source separation program has expanded, there has necessarily been a proportionate increase in the surcharges imposed in order to cover the increased costs. The revenue available for the source separation program is projected by multiplying the total surcharge by the anticipated tonnage (e.g., for fiscal year 91/92, \$8.78/ton times the surchargeable tonnage of approximately 360,000 tons amounts to approximately \$3,160,800).

The total cost of a battery recycling program cannot be estimated accurately. Costs would vary depending on the type of batteries to be collected, the method of collection, and the quantity of batteries to be collected. However, the current market quoted for household batteries can be obtained. Table 1 sets forth the current market (as of April 20, 1992) for household batteries. As indicated on Table 1, unless the County has recovered silver oxide batteries for sale (\$1.05 x spot market price for silver), no revenue is to be expected from a battery recycling program. Furthermore, collection, storage, transportation, packaging, and regulatory compliance costs are not included in the markets presented. Due to the limited market for household batteries, the County has not expanded its source separation program. As noted in Section 3.3, household batteries collected at the curbside are currently being hauled to a permitted hazardous waste landfill for proper disposal.

In 1990 it was estimated that the Lee County municipal solid waste stream contained 287 tons of waste household batteries (including alkaline, carbon-zinc, heavy duty, nickel cadmium, and silver, mercury and zinc-air button cell). The cost per pound for waste battery disposal, exclusively, was estimated to be \$0.29/lb. The disposal costs alone for the County's estimated 287 tons of waste household batteries was estimated to be \$166,460, or \$580/ton. This disposal cost does not include other significant costs which would be incurred by the County for collection, packaging, storage, transportation and compliance with federal, state and local regulatory requirements. An estimate of the total cost of disposal, including all known costs, was \$6,463/ton or \$1,854,881 for 287 tons of waste household batteries in 1990 (Rosania and Casey, 1990).

In addition to the current limited market for mercury-containing household batteries is the fact that the use of mercury in the manufacture of batteries is declining significantly. According to the United States Bureau of Mines, the use of mercury in the manufacture of batteries has decreased from approximately 952 metric tons in 1985, to approximately 250 metric tons in 1989 (Minerals Yearbook, 1989). Furthermore, according to the National Electrical Manufacturers Association, by the end of 1993 all of the major battery manufacturers will be producing batteries with no mercury added.

In view of the limited market for such batteries and the planned phasing-in of non-mercury containing batteries, it would not be prudent for the County to expand its battery source separation program. The capital (e.g., collection equipment), labor, transportation, packaging, storage, and permitting costs must be included in a cost estimate for recycling batteries. The cost of public awareness and education programs must also be included. Furthermore, any additional mercury emission control which might be obtained from such a program is not currently quantifiable.

TABLE 1

MARKET FOR HOUSEHOLD BATTERIES
(as of April 20, 1992)

<u>Type of Battery</u>	<u>Purchase Price</u>	<u>Cost¹</u>
Mercury household (including button cell)		If over 30% mercury by weight, cost is \$1.50/lb. If under 30% mercury by weight, no charge.
Silver oxide	\$1.05 x spot silver price	
Nickel-cadmium household		.65cent/lb.
Lithium ²		\$6.00/lb.
Alkaline/manganese/ zinc ²		.39cent/lb.

Source: April 20, 1992 telephone correspondence with Ms. Barbara Sawyer of Mercury Refining Co., Inc. (MEREKO).

Notes:

1. The cost of shipment of the batteries to MEREKO is not included in these amounts. The customer (e.g., the County) must enter into a contract with MEREKO first, then arrange for and pay all freight to MEREKO's Latham, New York facility. Additionally, the cost of regulatory compliance, including proper packaging and identification of the batteries, is not included in these market quotes.
2. These batteries are not recycled. They are disposed of through secure land burial in a hazardous waste landfill.

4.0 AN ANALYSIS OF SOURCE SEPARATION AS BACT FOR MERCURY CONTROL

Using material separation programs as a method of reducing emissions was briefly discussed in Section 4.1.5 of Volume III, Air Quality of the County's power plant site certification application. At the time of the application (June 28, 1991) there were no definitive EPA or other data to support the statement that materials separation alone was BACT. Nonetheless, the County did conclude that it would initiate programs to remove household batteries and lead-acid batteries from the waste stream to minimize possible emissions. As of this writing (May 1992), there are no available data which could be used in a BACT determination to accurately quantify the environmental, energy and economic costs of source separation as BACT for mercury.

In the EPA document Municipal Waste Combustion: Background Information for Materials Separation (January 1991), there is an analysis of the impacts of materials separation on combustor air emissions, operations, and ash quantity and quality. The subsection on air emissions includes a discussion of the impact of the magnetic removal of household batteries with other noncombustibles from the MSW to be combusted. The document states that:

...it is possible that in some cases their removal may have contributed to reductions in mercury, cadmium, and other metals. However, there are no data to demonstrate what quantity of mercury, cadmium, or other metal emissions from MWC's are due specifically to the combustion of batteries. (p. 5-16)

Lee County's research and analysis for this report on source separation as BACT for mercury control has uncovered only limited data. Furthermore, despite the paucity of scientific evidence, Lee County has undertaken one of the most comprehensive source separation programs in the United States for the removal of household batteries and other mercury-containing wastes from the MSW stream. The lack of available data does not allow the County to undertake a detailed BACT analysis, but the following sections present a discussion of source separation as BACT for mercury control at the Lee County resource recovery facility.

4.1 Top-Down BACT Methodology

On December 1, 1987, the U.S. Environmental Protection Agency Assistant Administrator for Air and Radiation issued a memorandum that established certain program initiatives designed to improve the effectiveness of the new source review programs. Among these was the "top-down" methodology for determining BACT, which is an emission limitation that achieves the maximum degree of reduction for a pollutant, taking into account energy, environmental and economic factors. Since the issuance of its 1987 memorandum, the EPA has required that BACT analyses be performed in the manner described below.

The first step in the top-down BACT analysis is to identify all "available" control options for the emission unit in question. Available control options are those air pollution control technologies with a practical potential for application to the emission unit and the regulated pollutant under evaluation. The control alternatives should include not only existing controls for the source, but also controls that have been applied to similar source categories and gas streams, and innovative technologies. Technologies required under Lowest Achievable Emission Rate (LAER) determinations are available for BACT purposes and shall be evaluated as a potential control alternative.

In the second step, the technical feasibility of the control option identified is evaluated with respect to the site-specific factors at the emission source. Based on technical constraints, any of the options can be eliminated from further consideration. However, the demonstration of technical infeasibility should be clearly documented to show that the technical difficulties would preclude the use of that control option.

In step three, the remaining control options which have not been eliminated are ranked in order of control effectiveness in a top-down manner. Starting with the top option, the control options are evaluated based on the following criteria:

- control efficiencies (percent pollutant removed);
- expected emission rate and emissions reduction (tons of pollutant controlled per year);
- environmental impacts;
- energy impacts; and,
- economic impact (i.e., incremental and total cost per ton of pollutant controlled).

The evaluation of the above criteria in a top-down manner either validates the suitability of the top control option listed as BACT, or provides clear justification that the top candidate is inappropriate as BACT. If the top alternative is inappropriate based on environmental, energy or economic impacts, then the next most stringent level of control is considered until a BACT determination can be reached.

4.2 Available Mercury Control Technologies

Mercury removal will be accomplished at the state-of-the-art Lee County resource recovery facility by using the County's existing pre-combustion source separation program and post-combustion add-on air pollution control equipment. Lee County will have the first resource recovery facility in the United States to employ pre- and post-combustion technologies, including a reagent injection system for the abatement of airborne mercury emissions. A full description of the facility's pollution control system for mercury and the facility's proposed mercury emission permit limits is contained in A Report on the Mercury Control System for the Lee County Resource Recovery Facility, prepared for the Department of Utilities, Lee County Florida, by Malcolm Pirnie, Inc., RTP Environmental Associates, Inc., and Clement International Corporation (April 1992).

The post-combustion add-on air pollution control technologies which the Lee County resource recovery facility will be employing are:

- dry lime scrubbing;
- fabric filter (baghouse); and,
- activated carbon injection.

Pre-combustion source separation will be achieved primarily through the County's existing mercury-containing waste collection and diversion programs as discussed in Section 3.0, supra. As a result, the municipal solid waste accepted for combustion at the Lee County resource recovery facility or as bypass waste at the County's landfill will contain fewer sources of mercury-bearing compounds than would be expected in the absence of these source separation programs.

4.3 Proposed BACT for Mercury

According to the top-down BACT procedures, the technically available control technologies are to be ranked in order of control effectiveness (i.e., from the "top-down").

It is anticipated that the addition of post-combustion control technology will result in much greater overall reduction of mercury air emissions than pre-combustion source separation. The post-combustion mercury control technology proposed for the Lee County resource recovery facility will achieve the maximum degree of reduction that is technologically possible at this time. Therefore, in a top-down determination, the post-combustion control technology that the Lee County resource recovery facility will implement (i.e., the combination of a dry lime scrubber, fabric filter and activated carbon injection) is equal to or better than BACT. The air pollution control system to be used by Lee County, with the inclusion of the activated carbon injection system, will be the first commercial installation of its kind in the United States.

The Lee County facility's post-combustion control technology may achieve a greater level of mercury control when combined with the pre-combustion source separation programs the County already has in place. Although source separation programs have not been demonstrated as BACT, the County will continue to implement these programs to augment the operation of its facility.

As discussed in section 4.0 of the aforementioned A Report on the Mercury Control System for the Lee County Resource Recovery Facility, the mercury content of MSW is declining in Lee County and throughout the United States. With household batteries accounting for up to 88 percent of the amount of mercury found in MSW, that would leave approximately 12 percent of the mercury deriving from various other sources in the MSW stream. These other mercury sources in MSW are not nearly as identifiable or quantifiable as batteries. For example, mercury may be found in thermometers, blood pressure gauges, fluorescent lighting components, film packs, special coatings for paper, and pigments for paints and other coatings. It would be exceedingly difficult and very costly for a source separation program to attempt to target such a wide range of materials which may or may not include meaningful quantities of mercury for source separation. Furthermore, as discussed in section 3.0, supra, many of these products are now or soon will be manufactured without mercury. By the end of 1993, the major battery manufacturers will be producing batteries with no mercury added. Paint manufacturers have also pledged to remove mercury from their manufacturing processes. This trend is likely to continue due to increasing consumer demand for non-mercury added products.

The County will continue to implement its successful battery source separation program as long as it is environmentally beneficial to remove batteries from the MSW

stream. Due to the declining usage of mercury in batteries, there may come a time when it is no longer necessary or appropriate to source separate batteries. The County would then re-evaluate the efficiencies and effectiveness of its source separation program. Of course, the County could not eliminate its program without the prior approval of the appropriate regulatory agencies.

Since the top alternative resulting in the maximum degree of reduction for mercury emissions will be implemented at the Lee County resource recovery facility, no further investigation of BACT alternatives (i.e., energy, environmental, and economic impacts) is required. Lee County has considered the energy, environmental and economic issues associated with its source separation program, but the impacts of a source separation program are not readily quantifiable. For example, more collection vehicles would be needed to collect and haul the recovered materials, which would result in the increased use of gasoline or diesel fuel. The exact level of increased energy use cannot be predicted. The environmental impacts of source separation are also difficult to identify precisely. These additional collection vehicles will create additional vehicle exhaust air emissions. However, the removal of mercury-containing wastes from the County's MSW stream may result in reduced mercury emissions from the Lee County resource recovery facility. Finally, the collection of additional source separated materials will most likely result in increased costs to the County (see Section 3.5, *supra*). The County would be required to obtain additional collection vehicles and hire and compensate additional workers to staff the program. Currently the County's haulers are collecting batteries at no added charge. In the event that more materials are added to the source separation program, these haulers will most likely request additional compensation. In addition to transportation costs are the increased costs of proper packaging, storage, regulatory compliance, and recycling or disposal.

5.0 CONCLUSION

Lee County has an extensive source separation program in place today with participation rates exceeding 90 percent. This source separation program is designed to collect batteries and other sources of mercury in the MSW stream. The County is committed to its source separation program and continues to demonstrate that commitment by expending additional funds and expanding programs.

The Brooklyn Navy Yard Remand Order and the Citizens for Clean Air v. EPA decisions do not require source separation to be used as an air pollution control technology in a permit to operate a resource recovery facility. Source separation programs have not been demonstrated to be BACT for mercury. The available data do not adequately quantify the energy, environmental or economic impacts of source separation programs used for mercury control.

Thus, Lee County's commitment to and continued funding and expansion of its battery and other mercury-containing waste collection program, together with its proposed post-combustion air pollution control system for the Lee County resource recovery facility exceeds BACT. Lee County will continue to implement its source separation programs as long as they provide meaningful environmental benefits.

6.0 REFERENCES

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