MWRA \ MASCO Hospital Mercury Work Group
Operations Subcommittee
Final Report

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APPENDICES

For a full copy of the report, which includes all the following appendices, please contact David Eppstein by email at deppstein@masco.harvard.edu, or by phone at 617-632-2860. Thank you.

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I. EXECUTIVE SUMMARY

Problem Definition:

The Massachusetts Water Resources Authority (MWRA) regulations prohibit the discharge of mercury from industrial, commercial and/or institutional sources to the sewerage system. The MWRA will enforce this regulation at a level of five (5) times the method detection limit (MDL) of 0.2 parts per billion (ppb) {based on US EPA analytical method 245.1} which presently results in an effective discharge limit of 1.0 ppb.

For the past year, the MWRA has been working with area hospitals and MASCO (a consortium of Longwood Medical and Academic Area Institutions) in a collaborative process that stresses cooperation and the pooling of resources to identify and address the problem of mercury contained in hospital and medical facilities' wastewater streams. To this end, the MWRA \ MASCO Hospital Mercury Work Group was formed with its charge to investigate the source(s) of the problem and to explore methods for its abatement.

The Work Group approached the problem from three directions. The Infrastructure Subcommittee focused on developing guidelines for the removal of residual mercury from hospital wastewater conveyance systems. The End of Pipe Alternatives Subcommittee concentrated on the identification and evaluation of potential mercury pretreatment systems. The Operations Subcommittee has been working to identify sources of mercury contamination and to develop source reduction management policies for their control. This Report describes the process employed, the resultant findings and recommendations for mercury abatement based on a policy of waste minimization and exclusion.

Approach:

In formulating a source control approach to the mercury issue, the Operations Subcommittee identified the following four basic project areas for study:

The initial ***Reagent Identification*** process was key in documenting existing data from available sources. As part of this process, a database worksheet was developed to capture the wide range of information known to, or produced by, the Member Hospitals and Institutions with regard to the mercury content of specific products. Next, a letter to major reagent vendors was developed to elicit supplier support in identifying the trace levels of mercury contained in their products. A follow-up vendor letter was also sent out to reinforce the significance of the issue and to stress the need for vendor cooperation. Chemical alternatives and product substitutions were requested for those products found to contain mercury.

In addition to this investigation of typical laboratory reagents, the group worked to identify ***Other Sources*** of mercury contaminants. A team of individuals from the Operations Subcommittee formed a task force to identify other potential sources of mercury ranging from Ajax Powder to Zinc-Form E Lids. The charge of this group was to look at the possibility that common products, not otherwise thought to be of significant importance or concern, might contain low levels of mercury. Thus far, a total of 118 such products have been identified by the twelve hospitals participating in the survey. Some of the results are explained in Section III.

To help ensure the technical validity of obtained data, this Subcommittee developed a standardized protocol for the ***Sampling and Analysis*** of reagents, biomass, products and wastewater effluents for mercury content. The Operations Subcommittee was asked to make the protocol flexible enough so it could be used by its individual members when soliciting future services from commercial laboratories for field sampling and analytical services. The Request For Proposal (RFP) which was subsequently developed was written to ensure consistency in sampling and analytical technique for all hospitals and institutions during the existence of the Work Group and beyond, so that additional information obtained could be incorporated into the Database.

The Operations Subcommittee also realized that there would be a need to develop a written ***Protocol and Training*** policy that could be used by its members to implement the Group's findings. Since the primary goal of this protocol would be to make the individuals using these materials more knowledgeable and aware of the mercury issue and proper disposal techniques, significant emphasis was placed on making the written materials user friendly and easily understood. The Group believes that 80% of their discharge issues can be solved through

employee training initiatives and subsequent adherence to standard operating procedures (SOP's) designed for the management of defined sources.

Findings:

The Subcommittee has found the presence of mercury in the workplace to be pervasive. Source control and reduction is the best way to address the problem since, as reported by another of the MASCO Hospital Mercury Work Group Subcommittees, there is no end-of-pipe solution. Further, we have also learned that we can not successfully manage the mercury discharge using even the most rigorous infrastructure maintenance program so long as we continue to pour mercury bearing products down the drain. Employees must become better educated about the mercury content of all the products they use...from the most sophisticated chemical reagents to the simplest cleaning products...if they are to properly manage their disposal.

The compiled ***Database*** provides the most current and complete information available on the sources of mercury present within the products consumed by the Member Hospitals and Institutions. Using all available inputs, a total of 5,504 products have been identified and inventoried. A significant number of these products have also been tested and found to contain mercury at some level. In addition, 118 common products, such as bleach, alcohol, laboratory lids and embedded tissue samples, have been identified as significant sources of mercury that were unknowingly being discharged to the sewerage system.

The Database was augmented by more than 61 vendor responses to the Subcommittee's request for product certification of mercury content. Although some of the responses failed to provide any new information, others proved to be quite useful. These positive replies helped to foster communication with some chemical suppliers which served to heighten their awareness of the issue and the emphasis being placed upon it by the participating hospitals and the MWRA. One vendor even pledged to develop mercury free alternatives for all of their products by the end of 1996.

The need to standardize the manner in which data on the mercury content of products is collected was also highlighted through the vendor information solicitation process. The differences in sampling methodology and analysis varied to such an extent that some of the initially reported results had to be remanded back for further evaluation.

Recommendations:

Based on their collaborative efforts, the Operations Subcommittee has developed the following recommendations to assist its members and/or affected facilities in formulating their own source reduction strategy for mercury:

Reagent Identification:

- Continue to work with the MWRA, Member Hospitals and Institutions, and others, to maintain and upgrade the Mercury Products Database.

- Continue to work with the MWRA, vendors and other suppliers of chemicals to identify mercury free substitutes for identified problematic compounds and effect their use wherever appropriate.

- Disseminate the Database information on the mercury content of products to other industries, trade groups and public agencies and encourage their use of this valuable resource.

- The Database file should be updated and sent to the Member Hospitals and Institutions on a semi-annual basis. Future methods for electronic transfers of the Database need to be developed and implemented.

- In order to provide the information required to complete the Database, a coordinated program to test all products for mercury content should be developed. A joint effort involving the MWRA, the Member Hospitals and Institutions and the vendors should be pursued.

Other Sources:

- As in the case of reagents, Other Sources need to continue to be identified through the efforts of users in cooperation with vendors. Use of the standardized procedures for sampling and testing should be employed to help ensure the uniform quality of the information entered into the Mercury Database.

- Testing of all brands of bleach, neutralization tank reagents, several brands of saline and incoming water should proceed as soon as possible.

- All laboratories should be made aware of the mercuric oxide presence in some types of hematoxylin stains. Also, fixers and developers, the T3 (Wallac) Kit containing thimerosol, and embedded tissues (all of which are used frequently in laboratories) must be managed appropriately. Provisions must be taken to ensure their proper disposal.

Sampling and Analysis:

- All Member Hospitals and Institutions should implement the prepared RFP when analyzing sources for mercury content to ensure the technical integrity of data obtained prior to its entry into the Database.

- All MWRA industrial discharge permit holders need to be made aware of method detection limit (MDL) for mercury and the MWRA's current interpretation of that limit.

Protocol and Training:

- All Member Hospitals and Institutions should maintain a complete and accurate inventory of chemicals known to contain mercury and refer to it when purchasing products. First line users of the wastewater system should also be required to consult the products Database before discharging waste materials down the drain. A mercury management policy, as a component of a complete chemical inventory plan, needs to be developed and/or strengthened by the Member Hospitals and Institutions.

- Steps should be taken to ensure that appropriate Standard Operating Procedures (SOP) for the proper disposition of products containing mercury be developed and implemented.

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II. REAGENT IDENTIFICATION

Problem Definition:

At the outset of this Work Group process, many hospitals were unknowingly using and discharging mercury because they were not aware that certain products in use within their clinical and research procedures contained mercury. Given the similarity of the types of laboratory activities conducted by these institutions, this was perceived as a common problem with, potentially, a common solution. Chemical reagents, in particular, used with regularity in a wide range of laboratory testing, were suspected of being likely sources of mercury contamination. The problem was compounded by the fact that the traditional methods of obtaining information on the composition of these products would prove to be inadequate. Material Safety Data Sheets (MSDS), for example, are not required to list the hazardous components of a product unless that component is present at a level of 1% (0.1% for carcinogens). This means that a particular product could contain up to 10,000 parts per million of mercury before the manufacturer would have to alert the users of that fact. In addition, there has not been any significant pressure brought to bear to encourage vendors and suppliers to manufacture and market "mercury free" alternatives.

Approach:

In attempting to compile a comprehensive list of all products being used by the various facilities, a reagent identification survey was developed by the Subcommittee and distributed to the Membership (Appendix A). Each of the Member Hospitals and Institutions was asked to provide as much information as possible regarding the products in use within their facility and return the questionnaire to the MWRA for subsequent entry into a Master Database. Requested information included the facility name, the product manufacturer, supplier, the chemical name, the CAS (chemical abstract service) number, the approximate annual volume used, how the product was being managed (either haul or dump), where the product was being used (clinical, research, other), whether the mercury content had been checked (via MSDS, vendor or laboratory) and, if so, the results in ppb, and any other relevant comments. These categories were used as the foundation for the development of the Master Database discussed later in this Report.

In addition to the request for information solicited from the Membership, the Operations Subcommittee agreed that the vendors should be contacted directly and asked to provide complete information about their products (inclusive of the "purity" of the product component materials). Accordingly, a letter was sent to 153 different vendors seeking their assistance in addressing the environmental and compliance concerns facing the Member Hospitals and Institutions and the MWRA. A follow-up letter was also sent to reinforce the significance of this mercury issue and to establish a deadline for receipt of the requested information. The letters, as shown in Appendix B, listed the names of the Work Group participants and described EPA, MWRA, State and Local governmental involvement in the process as well as the prohibitions and enforcement actions currently in effect. The letters also requested that suppliers provide verification of product mercury content via the submission of a state certified laboratory report. Finally, requests were made of the vendors to include information on mercury free alternative products or materials wherever possible.

The Subcommittee's next challenge was to develop a means of compiling all of the information which would be collected. A database worksheet was provided to the Member Hospitals and Institutions for review and comment. Based on their input, the information was worked into the Database in a way that would allow the information fields to be manipulated by an individual facility to suit their own particular needs. Some of the information that can now be readily accessed includes: facility information; product name and CAS number; manufacturer and/or supplier; address; contact; phone number, disposal methods; laboratory where used; MSDS information; mercury concentration; and, comments. Several additional fields were also incorporated into the Database in anticipation of the need for future expansions or specialized manipulation of contained data. Though not currently used, these fields can be activated, as required.

In an attempt to maximize the value of the Database, seventy-five (75) of the most commonly used products within the Member Hospitals and Institutions were selected and samples of each

were submitted to the MWRA Central Lab to be tested for mercury content (see Appendix C). The analysis results for these priority chemicals that have been generated by the MWRA lab thus far, is included as Appendix D. Due to the size of the overall Mercury Products Database, only that portion of it which contains those chemicals and products that have been verified, to date, to contain mercury at some level, has been included in Appendix E.
The entire Database is available to the general public through the MWRA and can be received in the following formats:

a. Hg database in a dBase III Plus Format
b. Hg database with the dBase III Plus Hg Application
c. Hg database in ASCII Format

Findings:
Thus far, there have been 61 replies to the 153 vendors letters that were mailed and responses continue to arrive, though slowly. Vendor response has been varied and a spreadsheet, presented as Appendix F, provides a summary of the responses received to date.
A total of 5,504 entries have been recorded into the Master Database using both vendor and member responses to requests for information. The current statistics for the Database are as follows:

a. Number of records that contain mercury data: **781**
b. Number of records with mercury concentrations below detection (BD): **166**
c. Number of records with mercury concentrations BD-1 ppb: **43**
d. Number of records with mercury concentrations 1-5 ppb: **53**
e. Number of records with mercury concentrations 5-10 ppb: **19**
f. Number of records with mercury concentrations > 10 ppb: **469**
g. Number of records under review of concentration data: **31**

The information included in the present database is current as of June, 1995. The MWRA will endeavor to update the file periodically and updated disk copies will be sent out to the Member Hospitals and Institutions on a semi-annual basis. Eventually, the MWRA hopes to be able to distribute the Database information electronically via an on-line service. To facilitate this updating process, all Member Hospitals and Institutions should continue to provide mercury content information on products to the MWRA as it becomes available.

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III. OTHER SOURCES

Problem Definition:
Based on independent work that had been done by many of the Member Hospitals and Institutions prior to the formation of the Work Group, it was known that mercury, to some degree, was present in many soaps, cleaners and other miscellaneous items. The task at hand was to determine which of these products contained mercury and to incorporate that information into the Master Database under the heading of "Other Sources". The responsibility for completing this effort was assigned to the Other Sources of Mercury Subgroup (OSMS) of the Operations Subcommittee.

Approach:
A survey was prepared and distributed to the Member Hospitals and Institutions asking them to identify all products used in and around laboratory sinks. Site visits were also made by an independent observer in an effort to identify all possible mercury sources. There was also an ongoing effort to coordinate with the MWRA's "Other Sources Industry Workgroup (OSIW)" which was attempting to address the same problem for other affected industrial groups. Communication between the two groups helped to prevent a duplication of their efforts. Accordingly, the OSMS primarily focused its attention on the evaluation of cleaners, soaps and similar items that might come in contact with wastewater. Their Report, presented as Appendix G, identifies known sources of mercury and also recommends some items for further testing.
Sampling techniques for sponges and the Tissue Tek brand of stainless steel process covers were also evaluated under the auspices of the OSMS. Due to the frequent use of gloves within the laboratory setting (as well as during the taking of samples), a strategy for sampling and analyzing various types of gloves was developed. Consideration was also given to all brands of bleach, reagents used in neutralization systems and the wide range of saline solutions used in laboratory immunodiagnostics. The level of mercury known to be present as an oxide in some types of hematoxylin stains was also ascertained. Fixers and developers used in photographic processors and x-ray developing units were singled out for definition as source areas. Testing of the incoming city water at several Member Hospitals and Institutions was also conducted.

Findings:
As a result of the complementary work undertaken by the OSMS and the OSIW, several additional products were identified as containing mercury and this information was added to the Master Database. Included among their findings were:

- Tissue Tek stainless steel process covers used in embedding were tested for mercury after soaking. In one round of tests, Decal-E lids were shown to leach 0.016 mg/l (16 ppb) of mercury and Zinc-Form E lids leached 0.004 mg/l (4 ppb) of mercury into the soaking solution;

- The T3 (Wallac) Kit contained thimerosol which was verified to be a significant source of mercury; and,

- At least four (4) cleaners, nine (9) soaps, embedding tissues and other miscellaneous items such as photoprocessing fixer and developer solutions each contain significant levels of mercury.

Appendix D presents the results of glove testing. The chart in Appendix G provides details on the products noted above.

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IV. SAMPLING AND ANALYSIS

Problem Definition:
After determining that sample analysis would be the most sure method for ascertaining whether a suspect material might contain low levels of mercury, the Subcommittee realized that a standardized protocol for sample collection, field preservation, proper analytical procedure and QA/QC measures would need to be prepared prior to contracting the services of a DEP certified commercial testing laboratory. Also, for cost saving purposes, the Subcommittee needed to establish the criteria that would help ensure that competitive pricing from commercial laboratories would be obtained in response to a request for proposals (RFP). The Subcommittee also realized that sampling and analytical services would potentially be required by all three (3) of the MASCO Hospital Mercury Work Group Subcommittees, so delineation of the types of samples involved (aqueous vs solid, concentrated vs dilute, etc.), requirements for field sampling support and sample identification and preservation all had to be detailed.

Approach:
At the outset of the process, each Subcommittee was asked to identify their respective needs for field sampling assistance, the number of samples expected to be analyzed and the form(s) of the samples (liquid or solid). Using these responses, the Operations Subcommittee (taking the lead on this common effort) structured the RFP for sample testing according to the three categories identified by each of Subcommittees. Broadly, the categories were reagents used in clinical and research laboratories, other chemicals used within the institutions and biomass contained within a facility infrastructure and wastewater.

The above efforts resulted in the preparation of a template type Request For Proposal (RFP) as shown in Appendix H. With assistance and technical guidance from the MWRA's, Toxic Reduction and Control Department (TRAC), Field Sampling Unit and Central Laboratory, standardized field and laboratory analytical protocols were developed and incorporated in the RFP.

Hospitals wishing to have samples analyzed can take advantage of the RFP, in whole or in part, as follows:

- Task 1 is intended for the analysis of reagents that are being discharged from a hospital into the wastewater.

- Task 2 is intended for the analysis of biological buildup (biomass) within the piping and is a twofold procedure (as is fully detailed in the Pipe Cleaning Protocol presented in the Infrastructure Subcommittee Report). A goal of the Protocol was to find a chemical which would dislodge or dissolve the biomass buildup using only chemical means. The theory employed was that removal of the biomass would also remove the adsorbed mercury.

- Task 3 is intended for the analysis of samples of industrial wastewater discharges from a facility.

The RFP outlines the parameters that should be required of a contract laboratory when providing services relating to the collection and proper analysis of samples for mercury. The laboratory is asked to prepare, handle and/or analyze all samples according to the detailed quality assurance/quality control procedures already approved by the MWRA. Aside from the individual Task implementation details, the following are common requirements of the RFP:

A. Certification:

1. The laboratory must be fully certified by the Commonwealth of Massachusetts and must be currently certified for mercury (code number 212 in non-potable water).

2. The laboratory must use EPA Method 245, "Cold Vapor Technique" when analyzing samples for mercury.

B. Sample Preparation:

1. Sample containers must be prepared according to QA/QC procedures.

2. Sampling containers must be clean.

3. Labels should be affixed to the outside of the containers with the listed preservatives, if any, checked off.

C. Sample Collection:

1. Samples must be collected according to QA/QC procedures. (Both grab and composite sampling techniques are outlined). Field preservation of samples must be performed according to the requirements of 40 CFR 136.3 (copy included in Appendix B). These, in part, include preparation of duplicate and blank analyses as well as matrix spike analyses.

2. The sampler must be familiar with the inspection, calibration and use of the sampling equipment being used.

3. All sampling equipment used must be in good condition and clean.

4. All samples must be recorded on "Composite and Grab Sample Record Forms". "Chain of Custody" Forms must also be executed. The chain-of-custody forms are to be provided by the certified laboratory that will analyze the samples. The chain-of-custody procedure includes recording all relevant sample collection data on the provided form at the time that the sample label is filled out. Data on the form must be checked to ensure that it matches label data and data collected in the sampling log book. Relevant information to be included on the Chain-of-Custody is:

    - Laboratory name & address.
    - Facility name & address.
    - Sampling date.
    - Date sample was received by lab.
    - Date sample results due.
    - Chain of custody #.
    - Sample ID.
    - Container (# and type).
    - Preservative.
    - Type of analysis required.

    The chain-of-custody form is transported with the samples and is signed, countersigned, timed and dated whenever the samples are transferred into new custody. Copies of all forms are kept on file.

5. Arrangements between the contractor and laboratory must be made to determine whether the samples will be delivered to the lab or picked up by the lab.

D. Sample Analysis:

1. Samples must be analyzed according to stipulated QA/QC procedures. The director of the certified laboratory is responsible for determining the frequency with which in-lab QA/QC procedures are conducted.

2. The contract laboratory must have established experience in the field of mercury analysis using EPA Method 245 "Cold Vapor Technique". Appendix C contains two descriptions of the method: Method 245.2 - Automated Cold Vapor Technique which is used in the analysis of mercury on surface water, and Method 245.5 Manual Cold Vapor Technique which is used in the analysis of mercury in soils and sediment. Any necessary changes in the above techniques, (e.g. changes in dilution amounts etc.) shall be determined by the laboratory.

3. The contract laboratory must be familiar with the inspection, calibration and use of the monitoring equipment necessary for this type of analysis.

4. All monitoring equipment must be in good working condition and clean.

5. All inspections and calibrations must be recorded.

E. Laboratory Reports:

1. Laboratory Reports must include, but should not be limited to, the following:
    - Laboratory name and address.
    - Date sample received and reported.
    - Method used for analysis.
    - Results of analysis.

Sample analysis must be completed in an efficient manner. A mercury detection limit of not less than 1 part per billion (ppb) must be used though 0.2 ppb is preferred. A minimum turnaround time of 24 hours following sample receipt at the laboratory (without premium cost escalator) is expected but negotiable. Since the overall cost of each set of analysis would be significant, the RFP requires the laboratory to consider the number of samples to be taken and to offer the most economical and competitive price rates for sample analysis.

Findings:

Following the preparation of the RFP, but before it could be issued, the MWRA offered the services of its Central Laboratory for the sample testing and analysis required by the MASCO Hospital Mercury Work Group. Accordingly, the RFP was not implemented during the course of the Work Group's tenure.

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V. PROTOCOL AND TRAINING

Problem Definition:

The best means for ensuring that compliance with the mercury prohibition is adequately addressed lies in the education of responsible personnel. The best way to educate personnel and to make them knowledgeable of the myriad number of sources that can contribute to the problem is by an ongoing program of training. In general, hospitals, institutions and other industries have all used similar training techniques. While some individual programs may be exceptionally detailed in certain areas, they may be lacking in others. The Subcommittee, therefore, set out to incorporate the best aspects of each program when developing a standardized Training Protocol for use by its members. This effort would help ensure that the necessary information could be passed on to affected employees within each Institution so that they could gain an appreciation for the problem and an understanding of how their individual efforts and diligence might help in the mitigation of future exceedences.

Approach:

The Operations Subcommittee compiled the **Protocol and Training Report**, as contained in Appendix I, based on the input received from its various members. The Introduction section discusses what mercury is and describes some of its uses. It also contains a brief history on the MWRA's and EPA's combined efforts with the Boston Harbor Clean-up project and how the mercury content in the effluent to the Harbor has an effect on the MWRA's NPDES Permit. The prohibition of mercury, as per 360 CMR 10.024(1)(a) is discussed, as is the relationship between the detection limit of 0.2 ppb and the enforcement threshold of 1.0 ppb.

This is followed by an overall discussion of prohibited substances, as per EPA's National Pretreatment Standards (40 CFR 403), plus an explanation of how numerous contaminants, solids, liquids and gasses can create specific hazards at a POTW. In addition, the Report notes that all MWRA Industrial User Discharge Permits (IUDPs), through the Regulations (360 CMR 10), expressly ***prohibit*** the discharge of polychlorinated biphenyls (PCB's), pesticides, phenanthrene and ***MERCURY*** to the sewer.

The Report also contains a chart which lists currently regulated pollutants along with their maximum discharge limits. This can be utilized when following the process flow diagram for the facility chemical inventory process as shown on page 4 of the Protocol and Training Report. Though this chart focuses on mercury, it can also be used generically for any pollutant of concern.

Another section of the Report provides information on the management of mercury sources. The primary elements discussed are procedures for identification, reduction and substitution, appropriate disposal practices and methods for managing a current database.

Educational approaches, in the form of training program outlines, are included, as are educational resources such as Agency/Institutional listings and associated telephone numbers. A glossary of terms explains several of the acronyms frequently used and the Appendix includes a general listing of many common, as well as not so common, mercury containing compounds.

Findings:

It is generally recognized that most of the hospitals and institutions have good hazard communication (HAZ-COM) programs along with other well established health and safety related protocols. The presence of written chemical inventory and tracking mechanisms along with methods for the screening of products for mercury content prior to their introduction or use at the facility, however, is limited. Since MSDS are required to divulge component information on only those products which contain concentrations of 1% or more (10, 000 ppb) of a hazardous constituent, they will not serve as an adequate basis for identifying all significant sources of mercury within the facility.

Preparation of a written Standard Operating Procedures (SOP), which contains clear, concise and accurate information, is an essential tool for use in training laboratory, facility and other operating personnel about the pervasiveness of mercury in the products they use on a daily basis. More importantly, the SOP details the methods for restricting the use of certain existing (and all new) products once they have been identified as mercury bearing. The collection and proper disposal (regulated, non-hazardous or hazardous waste collection) of these products is

critical when one is trying to achieve discharge compliance through a program of source reduction/waste minimization. This basic training of personnel should be provided at the time of hire and then be reinforced by periodic refresher training.
The key elements of a successful Protocol and Training program are:

- A policy statement by management that the awareness program applies to ALL employees.
- An explanation of the deleterious impacts that improper use of mercury products can have upon the environment.
- A definition of prohibited substances.
- A statement of the facility's sewer discharge limitations.
- A means for establishing a usable chemical inventory system and management process.
- A good HAZ-COM program which provides details on the origin, movement and fate of mercury in the environment.
- Techniques for the successful management of mercury sources.
- Recommended solutions for cleaning up mercury contaminated areas and names and contact phone numbers of emergency personnel.
- Describing product substitution initiatives.
- Outlining waste minimization approaches.
- Providing information on sources of additional educational resources.
- Creating a policy that allocates sufficient time and resources for employee's education on mercury abatement.

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