Draft Corrections #1

Olin CHEMICALS
P.O. BOX 248, CHARLESTON, TN 37310
(615) 336-4000

Site:
Break: 2.4
Other:

January 26, 1989

10103790

VERIFICATION OF RECEIPT REQUESTED

Mr. Greer C. Tidwell
Regional Administrator
United States Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

Re: Administrative Order No. 88-34-C

Dear Mr. Tidwell:

Pursuant to paragraph 13 of the above referenced Order, we hereby submit a proposed work plan within the prescribed twenty (20) days.

Sincerely,

Maurice Davenport

Maurice Davenport
Plant Manager
OLIN CORPORATION
Lower River Road
Charleston, TN 37310

MSD/8918:bap

Attachment

Site:
Break: 2.4
Other:

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PROTOCOL FOR MONITORING AND CLEANING HOMES

Prepared By:

ERM-Southeast, Inc.
PO Box 881
Brentwood, TN 37024-0881

January 25, 1989

Other Office Locations:

Marietta, Georgia
Charlotte, North Carolina
Mobile, Alabama

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PROTOCOL FOR MONITORING AND CLEANING

January 20, 1989

INTRODUCTION

The purpose of this protocol is to detail a procedure for identifying, monitoring, and cleaning homes with mercury contamination. This protocol is composed of five components; the first is a list of interested parties and their role in the cleanup operations. The second is a description of the personnel positions to be involved in the cleanup and a list of qualifications for each such position. The third is a description of the actual cleanup procedures to be used at the home. The fourth addresses the concerns of employees and other project details. Finally, waste disposal is addressed.

INTERESTED PARTIES

Note: This section has been included only to show that responsibilities should be spelled out in advance.

Employees

The employees will be responsible for allowing access to their homes, and must be present during the cleanup operations. A home will not be cleaned unless the employee and the homeowner consents to such action. ERM-Southeast will attempt to accommodate reasonable scheduling requests; however, the employees must also be reasonably flexible in permitting access to their homes.

Olin - Olin Will Be Responsible For:

1. Providing ERM-Southeast with the names of those employees whose homes have been designated by the EPA as requiring mercury decontamination per requirements of the Administration Order received by Olin on January 6, 1989.

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2. Providing facilities for the storage and/or disposal of any contaminated materials.

3. Providing the financial resources necessary for completing the cleanup. The ATSDR has made available urine testing to all workers' family members. It is assumed that ATSDR will conduct follow up on family members if this is necessary. Workers' expenses for medical testing and follow up should be available and compensated for through Workmen's Compensation.

Clean-up Contractor - The Clean-up Contractor Will Be Responsible For:

1. Providing a Nilfisk mercury vacuum system and all necessary cleaning equipment.
2. Arranging for the health monitoring for cleanup personnel.
3. Performing cleanup operations.

U.S. EPA - The U.S. EPA Will Be Responsible For:

1. Providing the list of homes requiring cleaning.
2. Supervising ERM's monitoring the homes following cleaning and reporting the results to the appropriate interested parties defined in the protocol. EPA will be provided the opportunity to oversee this monitoring since they will utilize the data.
3. Asking employees to evacuate their homes should EPA deem such action as necessary. Olin will also be notified of this action.

ERM - During The Cleanup, ERM Will:

1. Act as a liaison between the homeowners, Olin, the cleanup contractors, and the U.S. EPA.
2. Train and supervise the cleanup personnel.

3. Perform the administrative aspects of the cleanup operation (e.g., notifying the U.S. EPA of homes cleaned).
4. Arrange for any health monitoring for ERM-Southeast employees.
5. Attempt to locate those employees not contacted by EPA during the recent survey. If the employees are located, EPA should sample their homes and determine if cleaning is necessary.
6. Monitoring the homes for mercury levels after cleanup using dosimeters and the Jerome 411.

LIST OF HOMES

Table 1 (must be provided by EPA) summarizes the names and addresses of all homes to be cleaned. A brief description of the mercury levels found in each home during home monitoring is presented in Attachment A (must be prepared). Scheduling homes for cleaning may be difficult given the employees schedules. Thus, to facilitate scheduling, each employee whose house requires cleaning will be asked to submit a list of available times (Table 2 which must also be prepared). This information will be used to generate a schedule.

PERSONNEL AND QUALIFICATIONS

ERM-Southeast will train or supervise personnel in several positions during the course of the project. These positions are listed below. In no instance will minors be employed in any position.

1. Administrative secretary
2. Cleanup personnel
3. ERM-Southeast on-site coordinator (OSC)
4. Assistant

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Administrative Secretary

The administrative secretary will be responsible for notifying the effected homeowners and arranging for access to their homes. The administrative secretary must be someone familiar to the employees and whom the employees generally respect and trust.

Cleanup Personnel

The cleanup personnel will be responsible for performing the cleaning operations of the project. Cleanup personnel must understand and follow the health and safety and cleaning procedures to be used. At a minimum, cleanup personnel should meet the requirements of 29 CFR 1910.120. 1910.134, and 1910.1200. To ensure that cleanup personnel understand these procedures, cleanup personnel should be able to read and write. Cleanup personnel should also practice good personal hygiene and be courteous. Cleanup personnel will also be bonded. ERM-Southeast personnel will provide the necessary training for these personnel.

ERM-Southeast On-Site Coordinator (OSC)

The ERM-Southeast OSC will perform the administrative aspects of the operation and supervise the cleanup operations. The principal OSC must be someone with a degree in the environmental/medical sciences or a related area and must have experience. This person will be Mr. Tony Chatman whose resume is included in Attachment B. Back-up OSCs will be available to relieve the principal OSC, as needed. Personnel who may serve as backup OSCs include Lisa Hughey, Les Vantrease, and Jim Wallace. Their resumes are included in Attachment B also. The latter personnel will be utilized only to relieve the principal OSC periodically and in case of unforeseen situations.

Assistant

The "assistant" will assist the OSC on a part-time basis in tasks such as xeroxing and running errands.

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Personnel Training and Monitoring

All cleaning and supervisory personnel shall have been trained so as to meet the requirements of 29 CFR 1910.120, 1910.134, and 1910.1200 (OSHA regulations). All personnel who will be involved in handling wastes at a secure storage area shall be trained so as to comply with 40 CFR 262.

A pre-project and post-project physical will be given to all workers. This physical will include pulmonary function tests, urine test, and a neurologic examination (reflexes, tremors, etc.). If the project duration appears as if it will exceed eight weeks, and if homes with an appreciable mercury level (greater than 50 ug/m^3 indicated by mercury dosimeter monitoring) have been cleaned, cleanup personnel will receive a similar examination during the course of the project.

Prior to any work in potentially contaminated homes, all workers will have a brief (half day) orientation on the health and safety, and cleanup procedures to be used. Refresher briefings (approximately 15 minutes) will be held weekly. All personnel will sign a statement attesting to such instruction upon completion of the training. The orientation given to cleanup personnel will include a discussion of the:

1. Exposure routes and toxicity of mercury.
2. Protective equipment to be used.
3. Recommended personal hygiene.
4. Pre- and post-monitoring physical examination.

MONITORING/CLEANUP/DISPOSAL OPERATIONS

The cleanup procedures to be used will depend upon the levels detected and, as such, must remain flexible. A general outline of the procedures to be used, however, is presented below.

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Monitoring

A Jerome Model 411 mercury vapor analyzer in combination with dosimeters will be used to detect mercury in the homes of the employees. The detection limit of the Jerome Model 411 is 3.0 ug/m^3 (according to the manufacturer). The limit of detection with the dosimeters is 0.5 ug/m^3.

These data concerning mercury levels in employees' homes have already been collected by the EPA and the data which Olin/ERM does not already have access to should be made available by EPA. The U.S. EPA, Olin, and the employee will be notified of any detectable mercury readings obtained after cleaning.

Protective Equipment

For any home in which a detectable mercury level is found, all personnel will wear: disposable shoe covers, gloves, and coveralls. For homes containing 50 ug/m^3 or greater concentrations as previously determined by EPA using dosimeters, (the NIOSH 10 hr TWA is 50 ug/m^3), half-face respirators, gloves, disposable shoe covers, and poly-coated Tyveks will be worn. The ERM-Southeast Health and Safety Plan delineates the personal protective equipment use in greater detail. Any subcontractors utilized in the cleaning operations should prepare and follow their own Health and Safety Plan which must follow applicable state and federal regulations.

Cleaning Procedures

The cleaning procedures used in the homes of employees will depend upon the levels of mercury detected. No protocol, however detailed, can encompass every situation to be encountered. ERM-Southeast will utilize reasonable cleaning procedures in every home. If mercury concentrations are found <5 ug/m^3 in a particular area in a home, cleanup procedures, consisting primarily of vacuuming with a Nilfisk vacuum will first be used.

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The cleanup procedures to be used if mercury levels ≥ 5 ug/m^3 are found will depend upon the extent of contamination. If, in the judgment of the ERM-Southeast OSC, the mercury contamination is localized (e.g., dust under a refrigerator), then more extensive cleaning procedures than vacuuming will be utilized only in those areas. Washing the contaminated areas with water or a mercury binding solution (e.g., HgX) will be the primary cleaning procedure used. Paper towels will be used to clean the contaminated areas, and all paper towels will be disposed of in the same manner as a controlled waste. Once a paper towel has touched a potentially contaminated area, it will not be placed into the cleaning solution. Thus, any excess cleaning solution will not contact mercury and will not become a hazardous waste. Vacuum cleaners will be decontaminated in the same manner.

If the mercury contamination appears to be ubiquitous, the cleanup procedures will encompass the entire home and may include vacuuming, washing, or dusting all floors, walls, windows, ceilings, and personal possessions.

A general overview of the cleaning procedures is presented below:

Vacuuming - Floors in the home, including closets, will be vacuumed. The floors under furniture will be vacuumed unless: (1) the homeowner does not want furniture moved, (2) movement of the furniture could injure workers or damage the furniture. If contamination is present and the furniture must be moved to eliminate the contamination, the latter exception [(2)] would not apply.

Sink Traps - Sink traps will be drained either by removal of the plumbing fixtures or by placing HgX in the drain and pumping out the drain.

Washing Machines - ERM-Southeast will monitor washing machines, and if detectable mercury concentrations are found, will clean the machine. HgX will be placed in the machine during the wash cycle.

Shoes - ERM-Southeast will clean shoes, if needed, with an HgX or similar solution, or by vacuuming.

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Personal Possessions - During the cleanup, it may be necessary to remove personal possessions from the homes. Clothes, for example, may be contaminated. Clothes would be taken to a laundry and cleaned. The disposition of other items cannot be predetermined and will be determined on a case-by-case basis. ERM-Southeast will work with the employees to minimize inconvenience to the employees.

In the event, the items must be taken from the home, the homeowner will be presented with a receipt for the item. Olin/ERM-Southeast assumes responsibility for return of item, replacement of the item, or compensation for the item. The receipt will show where the item will be stored. Within two weeks, ERM-Southeast will decide if decontamination is feasible. If the homeowner wants the item returned even if the item cannot be decontaminated, the item will be returned if the homeowner will sign a statement acknowledging that the item is contaminated.

Vacuum Cleaners - Vacuum cleaners will be decontaminated in the home, if possible, by (1) appropriately disposing of the vacuum cleaner bag as contaminated material, (2) rinsing (using paper towels) the easily accessible parts of the vacuum, and (3) removing any dust from the vacuum attachments. If the vacuum must be removed from the home, it will be returned or replaced within one week. Replacement parts may be provided. Items will be checked by ERM-Southeast to be cleaned before returning the item to the home.

All contaminated cleaning materials will be delivered to Olin in Charleston, Tennessee, for storage, sampling, and disposal at an approved waste disposal site. All contaminated cleaning materials will be delivered to Olin in plastic bags to facilitate handling of the material. It is ERM-Southeast's understanding that the U.S. EPA by acceptance of this protocol will not require ERM-Southeast or the cleanup contractor to obtain any type of permit or follow any administrative procedures in order to transport the contaminated materials to Olin. Furthermore, the U.S. EPA agrees that the act of cleaning the homes does not constitute the generation of a hazardous waste by ERM-Southeast, or the cleanup contractor and therefore, neither party will be considered a generator nor transporter of hazardous waste. ERM-

Southeast will write a letter requesting a waiver from the hazardous waste regulations, if necessary.

Post-Cleanup Inspection

Once per week ERM-Southeast will notify the interested parties of homes ready for inspection and the U.S. EPA and the OSC, if available, will inspect the homes cleaned during the preceding week. ERM-Southeast personnel will have already surveyed the homes with the Jerome 411 and dosimeter. If EPA has an OSC present, he will also be notified four hours prior to ERM's clearance sampling for each house and will have the opportunity to be present during the sampling and to participate in the sampling if EPA so desires. In addition to sampling with the Jerome 411, a dosimeter will be placed at the breathing level in the living room of each home and aspirated at a rate of 50 cc/min for 12 hours. ERM will then analyze the dosimeter and determine if any mercury remains in the air after cleaning. Once the data are available, EPA will then notify the homeowner of mercury levels found in the home. If no "hot spots" are found in the homes/washer/automobile by use of the Jerome 411[1] (as per page 5, paragraph 9 of the Administrative Order), and the level (if any) detected by the dosimeter in the living room is ≤ 0.5 ug/m^3 (as per page 2, paragraph 7 of the Administrative Order), the U.S. EPA will pronounce cleaning operations at the home to be completed. If mercury vapor is found at a level in excess of 0.5 ug/m^3 by using dosimeters, the home or portions thereof will be re-cleaned. More frequent inspections (more than once per week) by the U.S. EPA may be needed if such inspections would permit any displaced families to return to their homes.

[1] Refer to page 6 for the detection limit of the Jerome 411.

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WASTE DISPOSAL

Overview

All wastes generated during the home cleaning operation should be collected and transported to a central secure storage area for testing to determine if the materials are hazardous wastes. As a precaution, the secure storage area should meet all of the requirements of 40 CFR 262, including the requirements for containers, labelling, and inspection.

Containers

All liquid wastes should be kept in closed top metal drums or plastic carboys in good condition. Cleaning materials (rags, sponges, protective clothing) should be placed in plastic bags (30 gal.) after use. The plastic bags should be placed into open top drums. Solid cleaning materials can be compacted into the drums to reduce the number of drums and associated storage space required.

Sampling

Once in the secure storage area, samples of all liquid should be collected and analyzed for total mercury. If the total mercury concentration exceeds 0.2 ppm, the liquid is hazardous and the drum should be labelled appropriately.

Obtaining representative samples from the solid cleaning materials will be difficult. The cost of segregating cleaning supplies, obtaining representative samples, and analyzing the samples could exceed transportation and disposal costs. For this reason, it is recommended that all solid cleaning supplies be put in a secure landfill and the containers be labelled appropriately.

During cleaning, some household items may need to be removed in order to adequately clean the homes. If the items are non-porous, wipe samples should be taken. At least 10 percent of the items should be wiped. The Jerome 411 mercury vapor analyzer should be used to determine if the wipe contains mercury. If detectable mercury concentrations are found, the item should be cleaned and retested, or a sample should be collected for EP Toxicity

mercury analysis. If the EP Toxicity mercury concentration exceeds 0.2 ppm, the material should be handled as hazardous.

Porous materials removed from a home should be sampled for EP Toxicity mercury concentration. If the EP Toxicity mercury concentration exceeds 0.2 ppm, the material should be handled as hazardous.

Container Labelling

All materials determined to be hazardous materials should be labelled according to the requirements of 40 CFR 262. The hazardous waste number should be listed as D009. The drums should not be labelled with hazardous waste number U151 (a listed hazardous waste), as the materials are not a listed waste. Labeling of material will occur once it is transported to Olin's facility in Charleston, Tennessee.

Transport/Disposal

All hazardous wastes should be transported to a secure TSDF. All hazardous wastes should be disposed of in a RCRA permitted hazardous waste disposal facility.

Non-hazardous wastes may be disposed of in a permitted solid waste disposal facility.

Regulatory Issues

As previously stated, it is assumed that the transport of any of the material back to the Olin facility will not require a transporter's license by the EPA.[2] It is also assumed that generation of these materials will not cause ERM-Southeast or the cleanup contractor to become a generator of hazardous waste. ERM also assumes that the airing of any of the houses in order to reduce mercury levels will not impact SARA/CERCLA, or Title III for a mercury release. Acceptance of this protocol by the EPA signifies EPA's agreement with the above assumptions.

[2] Waste will be transported to the Olin facility by either ERM-Southeast or Olin vehicles.

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PROPERTY ACCESS

Non-government personnel do not have legal authority to obtain a warrant to access the property of anyone who does not desire their home cleaned by Olin or representatives of Olin.

This limitation could compromise the ability to implement an effective cleaning program.

Secondly, some employees may not own their residence, but instead may rent. The owner may not want the house cleaned. Some type of release may be needed.

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ATTACHMENT B

The ERM Group

Professional Profile

Tony E. Chatman

Fields of Competence
Development, implementation and management of air pollution and hazardous waste chemical landfill investigations. Monitoring of numerous chemicals released into the atmosphere, surface water and ground water from stationary industrial sources, landfills and mobile sources. Dispersion modeling of pollutants and determination of ultimate fate of chemicals in the enviromnent. Liaison between industry and regulatory personnel regarding chemical emission and permitting of sources in the area of air pollution, surface waters and sewer discharge activities. Measurement of indoor air pollutant concentration pertaining to Occupational Safety and Health Administration (OSHA) guidelines. Experienced in all aspects of the OSHA Right to Know Law and recent SARA amendments.

Experience Summary
Three years experience as the environmental engineer with a major aircraft manufacturer in the Southeast. Negotiated all permits for air, water (NPDES) and sewer; actively engaged in negotiations with local, state and federal regulatory personnel regarding volatile organic chemical (VOC) emission emanating from aircraft paint spraying booths. Experienced in all phases of installation and operation of pollution control equipment. Directed the operation of a million gal/day ion exchange water treatment facility for water reuse in several chemical processing facilities. Responsible for all inhouse environmental audits. Oversaw compliance with state and federal laws pertaining to underground storage tanks and devised a program to monitor and test for leaking of such tanks. Maintained compliance for federal laws pertaining to the operation, removal and disposal of PCB transformers. Responsible for the maintenance and removal, if necessary, of asbestos within the facility. Oversaw the disposal of all hazardous waste via TSDF's (Treatment, Storage and Disposal Facilities).
Seven years experience with environmental consulting firms. Actively engaged in management and logistics of ambient air monitoring of ozone, hydrocarbons, oxides of nitrogen and sulfur, reduced compounds of sulfur, particulates and various other pollutants. On-site selection for establishing ambient air monitoring networks and calibration of continuous instruments for certain of the above pollutants. Modeled air quality and fate of chemicals in the environment. Prepared environmental impact assessments. Permitting to include construction, operation and Prevention of Significant Deterioration (PSD). Provided expert testimony in court cases.
Worked with industries and regulatory agencies in monitoring and assessing of chemicals emitted into the atmosphere, surface water and ground water from hazardous chemical landfills to include sample collection, analysis, data evaluation and report preparation.
Laboratory director for a local air pollution agency for a major metropolitan area. Provided laboratory direction for all aspects of data measurement including wet chemical and continuous techniques. Experience with all aspects of instrumental analysis.

Credentials
(b)(6) Personal Privacy [redacted]

Key Projects
- Evaluation of mercury vapor emissions from soil and multiple point sources for an industrial client in North Carolina.
- Investigation of an abandoned hazardous waste site in Pennsylvania to evaluate the rate of release of volatile organic compounds from the site.
- Air emission testing, ambient air quality monitoring and modeling program for emissions from an organic facility and inactive solid waste disposal site in Tennessee.
- Extended (12 months) ambient air and meterological monitoring and computer modeling of emission from a large thermoelecric facility in Venezuela.
- Design and implementation of a 12-month air quality and meterological testing program to evaluate the impact of emission from steam injection/oil extraction facilities in Venezuela.
- Permitting of a new large chemical facility and associated hazardous waste incinerator in New Jersey.
- Ambient air assessment of PBB emissions from a hazardous waste chemical site in Michigan.
- Carbon monoxide and noise monitoring and computer modeling for an environmental statement on highway improvements in Tennessee.
- Preparation of a PSD statement for expansion of a large pulp and paper mill located in the Southeast.

Professional Affiliations
Air Pollution Control Association
Society for Environmental Toxicology and Chemistry
Tennessee Academy of Science

Publications
Author and co-author of four technical papers on environmental pollution, plus numerous presentations at technical conferences.

The ERM Group

Professional Profile

Lisa A. Hughey

Fields of Competence

Engineering and management for hazardous waste projects including investigation and remediation of Superfund sites, ground-water contamination and remediation. Expertise in the collection of samples to provide data regarding the extent of contamination at Superfund sites. Liaison with local, state and federal agencies, and legal counsel.

Experience Summary

Three and a half years experience as a regional manager with a state regulatory agency (TnDHE). Extensive experience in conducting investigation, remediation and monitoring activities at Superfund sites in Tennessee, including working with responsible parties, local, state and federal agencies and legal counsel. Review of investigation and remedial design plans to insure compliance with established design criteria and standards. Extensive on-site work has been conducted which includes installation of monitoring wells, determining sampling points and parameters for which analysis will be performed, collection of ground water, surface water, soil and sediment samples according to EPA approved methods.

Credentials

(b)(6) Personal Privacy [redacted]

Key Projects

- Conducted Superfund site inspections at over 50 inactive hazardous waste sites.
- Project manager on over 20 Superfund site remedial investigations.
- Project manager overseeing implementation of remedial design at seven Superfund sites.
- Prepared hazard rankings of Superfund sites for the State of Tennessee.
- Project manager overseeing investigation and remediation of contamination caused by leaking underground storage tank at a tank farm in Knoxville, Tennessee.
- Project manager for remediation of a PCB contaminated Superfund site in Tennessee.
- Conducted investigations to determine if imminent hazards existed at three underground storage tank sites in Tennessee.
- Reviewed SPCC plan for industrial client.
- Prepared demolition landfill permit for industrial client.
- Prepared baler permit application for municipality.

Professional Affiliations

American Society of Civil Engineers

Publications

Author or co-author of four papers and presentations dealing with Superfund activities in Tennessee.

Environmental Resources Management

Professional Profile

Leslie F. Vantrease

Fields of Competence

Involved in various phases of water quality and biological sampling surveys. This experience includes chemical and microbiological analysis concurrent with surveys.

Experience Summary

Five years' experience including sample collection for biological/chemical water quality surveys in freshwater and marine environments. Specialized testing including complex micro-biological studies, nutrient uptake rate studies, reaeration rate studies, and studies to determine the stripping rate of various compounds from water. Source testing and the ensuing analysis for particulate, sulfate and sulfide. Set-up and maintenance of a high volume network for sampling particulate and particulate lead. Water quality modeling employing one-dimensional models.

Two years' experience in collection of samples to provide information on the extent of contamination at an industrial plant site and the feasibility of making the site environmentally secure including ground water, lagoon and soil and sediment sampling used for the determination of the concentration and distribution of environmental contaminants.

Credentials

(b)(6) Personal Privacy

Key Projects

- Comprehensive water quality and biological quality investigation and evaluation of a marine bay impacted by an oil refinery in Venezuela.
- Comprehensive water quality investigations and evaluations to be used for water load allocations in an estuary impacted by various industrial facilities.
- Investigation of the ultimate fate of nitrogen compounds in an estuary.
- Evaluation of the impact of a strip-mining operation on the water and biological quality on a basin in Alabama.
- Investigation of the ultimate fate of nitrogen compounds in a waste treatment facility and its receiving stream in West Virginia.
- Monitoring of contaminants in a tidally influenced water system in New Jersey.
- Monitoring of superfund and non-superfund hazardous waste sites throughout the United States.
- Comprehensive investigation of the water quality and biological quality of an extensive impounded river system in Alabama.
- Operation of bench and/or pilot scale industrial wastewater units at facilities throughout the United States.
- On project team that predicted future impacts of hazardous waste sites upon the environment.

ERM-Southeast, Inc.

MR. JIM WALLACE
RESUME

ERM-SOUTHEAST, INC.
215 Centerview Dr.
Suite 110
P.O. Box 881
Brentwood, TN 37027

ERM-Southeast, inc.

BIOGRAPHICAL DATA

JIM WALLACE

Date of Birth:	(b)(6) Personal Privacy [redacted]
Health:	Excellent
Marital Status:	Married
Children:	4
Current Position:	Consultant - ERM-Southeast, Inc., Brentwood, Tennessee
Business Address:	ERM-Southeast, Inc. 215 Centerview Dr. Suite 110 P.O. Box 881 Brentwood, Tennessee 37027 Telephone: (615)373-3350
Education:	(b)(6) Personal Privacy [redacted]
Experience:	1986 - Present Consultant for ERM-Southeast, Inc. 1979 - 1986 Duracell U.S.A - Lexington, North Carolina Manager, Environmental, Industrial Hygiene and Safety Engineering - Responsibilities included identification and monitoring of all hazardous materials in use. Formulated and implemented controls while monitoring their success. Translated waste water standards into required actions and abatement plans. Directed efforts to upgrade present industrial treatment facility.

Responsible for insuring that plant environmental controls functioned, including baghouses, vacuum systems, HVAC systems, hoods, and wet collectors. Duties include inspection, engineering, writing specifications, and purchasing, designed the present industrial ventilation system.

Responsible for budgeting and purchasing,including written justifications and obtaining quotes.

Key member of the Safety and Health Program. Use and evaluation of OSHA code embodied numerous areas from usage of asbestos to radiation producers. Transmitted medical requirements of all operations. Established the need for and type fo PPE. Trained employees in use and maintenance of protective equipment. Wrote company/plant health and safety policy and guidance series. Implemented programs for safety policy and guidance series. Implemented programs for safety glasses, and training in areas of handling chlorine, lifting, hazard communication and forklift operations. Chairperson of Plant Safety Committee.

United States Air Force Chief of Bioenvironmental Engineering Services (1976/Feb. 1979) for McClellan Air Force Base. Was responsible for the surveillance of the industrial environment of approximately 20,000 employees, from the design of facilities to disposal of wastes. This position required an understanding of sanitary engineering, industrial hygeine, health physics, systems safety engineering and numerous other allied disciplines. Directed a staff of three industrial hygienists, ten environmental health technicans and one secretary.

Chief of Occupational Safety and Health Engineering Division (1975/1976) - For McClellan Air Force Base. Provided consultative engineering services to U.S.A.F. bases in 22 states in the field of noise control, industrial hygeine, industrial ventilation, PPE. Supervised four engineers and numerous engineering technicians.

Chief of Bioenvironmental Engineering Services (1974/1975) - At the U.S.A.F. Hospital, Utapao, Thailand. Responsibilities were equally divided between occupational health, environmental management and preventive medicine.

Chief of Bioenvironmental Engineering Services (1971/1974) - At U.S.A.F. Rocket Propulsion Lab - Edwards Air Force Base. Addressed numerous potential hazards including diffusion of emissions, sensitive and toxic chemicals, cryogenics, high pressures and temperatures, heat stress, high voltages, and routine industrial problems emanating from fabrication and maintenance operations. Formulated research programs and directed ongoing efforts.

Chief of Air Engineering Division of U.S.A.F. Environmental Health Lab McClellan Air Force Base (1967/1971) Provided consultative engineering services Air Force wide in evaluation and control of air pollutants. Supervised three engineers, one air pollution meterologist, two allied scientists and numerous technicians.

Student (1965/1967) - Completed program specifically tailored to meet diverse educational requirements of Bioenvironmental engineering.

Staff Bioenivronmental Engineer - Torrejon A.F.B., Spain. (1962/1965) - Provided consultant services in occupational safety and health to thirteen Air Force installations.

Base Sanitary and Industrial Hygiene Engineer - Channault A.F.B. (1958/1962) - Worked in the areas of industrial hygiene, sanitary engineering, health physics and public health.

Professional Certificates: Professional Safety Engineer, State of California. Certified Hazard Control Manager, International Hazard Control Managers.

Professional Organizations: American Conference of Governmental Industrial Hygienists.

References: Professional and character references available upon request.

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ERM-Southeast, Inc.

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DRAFT

DETAILED PROTOCOL FOR MERCURY INDOOR AIR SAMPLING

Prepared By:

ERM-Southeast, Inc.
PO Box 881
Brentwood, TN 37024-0881

January 20, 1988

Other Office Locations:

Marietta, Georgia
Charlotte, North Carolina
Mobile, Alabama

DRAFT

DETAILED PROTOCOL FOR MERCURY INDOOR AIR SAMPLING

INTRODUCTION

Certain residents may have mercury levels in their homes. These residents in question alledge to have contaminated their homes with mercury through their work activities.

The objectives of this mercury air sampling protocol are as follows:

1. To determine the relative magnitude and concentration of mercury in the homes.
2. To provide consistent and representative procedures for sampling between different homes and vehicles.
3. To demonstrate adequate removal of mercury from the homes.

Items 1 and 2 have already been accomplished in the recent EPA mercury sampling survey.

INSTRUMENTATION

The following describes procedures for use of the Jerome 411 Gold Film Mercury Vapor Analyzer and Jerome mercury dosimeters. This procedure is also appropriate for utilization with the Jerome 511 Gold Film Mercury Vapor Analyzer.

1. Prior to use, the analyzer should be subjected to the Film Heat procedure in the appropriate manual. The bridge balance should be adjusted not sooner than one hour after the Film Heat procedure, according to published guidelines.
2. Sixteen hours of battery charging are required to completely charge the battery of the analyzer.
3. The flow rate of 750 cc/min across the gold film should have been checked within the last three months either by the analyst or by the factory. The procedure for flow testing and for flow adjusting are provided in the manual.
4. The analyzer should have been factory calibrated within the last three months. Daily, a functional test procedure should be performed by the analyst to insure that the analyzer

is performing correctly. This procedure does not replace a recent factory calibration but only indicates that the analyzer is detecting a level of mercury.

5. The intake filter disc should be replaced after 20 hours of sampling or more frequently if dust is visible.

6. Since the instrument operates by changing the resistance of a gold foil, drastic changes in the temperature of the instrument should be avoided during sampling. The instrument should be allowed to equilibrate when sampling in rooms of significantly different temperature. Similarly, care should be taken when sampling near hot or cold areas (i.e., space heaters, wood burning stoves, etc).

7. Analysts using the Jerome 411 instrument should touch a metal object (door knob, i.e.) to discharge static electricity between readings.

8. The Jerome instrument should not touch an object being sampled such as a rug; the monitor may be brought in close proximity to the object being sampled.

9. The Jerome 411 instrument should be utilized in the sample mode (10 sec sampling) to determine mercury levels. Areas such as carpeting, closets, drains, vacuum cleaners, washing machines, etc. should be checked. For vacuum cleaners, the one-second survey mode is recommended for monitoring to prevent overloading the gold film. The vacuum cleaner should not be operating during this sampling.

10. The analyst should periodically take proximity readings of his/her clothes and shoes to ensure that trace levels on the analyst's clothes are not a source of mercury.

11. Prior to use of any dosimeter, the dosimeters should undergo complete desorption of adsorbed mercury according to published procedures.

12. The low flow sample pumps should be calibrated using a flowmeter which has been calibrated against an appropriate NBS standard. The flow rate should be 50 cc/min.

13. A mercury dosimeter should be placed at the breathing level in the living room in each home and air aspirated through them at a rate of 50 cc/min for a period of 12 hours.

DRAFT

14. After completion of the dosimeter sampling, desorption of the mercury should be done according to Jerome published procedures. Each dosimeter should be desorbed three times to ensure that all mercury is removed and the results added.

MONITORING PROCEDURES

Monitoring should identify and document the presence of any mercury in the homes. Identification and documentation are equally important. The purpose of identification is to locate any mercury bearing areas of a home. The location of these areas must be documented so that further actions as needed can be planned. To accomplish both goals, the following steps should be implemented.

1. Ambient air readings should be taken in each room by holding the Jerome at chest level and walking through the room while collecting a sample (ten-second sampling mode). At least three such readings in each room should be collected. The analyst should discharge static electricity between readings.
2. Proximity (near surface), mercury readings should be taken in each room. Indoor areas to be checked are:
   a. floors/carpeting;
   b. upholstered furniture;
   c. furnace intakes;
   d. vacuum cleaners;
   e. shoes;
   f. any outdoor rugs (i.e. welcome mats);
   g. closets;
   h. clothes hampers;
3. The air temperature in each room, or series of connected rooms, should be measured and recorded. Note if the windows are open or closed.

4. Proximity readings should also be collected from the floorboards of all vehicles. The air temperature should be at least 70°F. This air temperature can be achieved by parking the car in full sunlight, in a heated garage, or by running the car with the heater on. When entering the car to monitor it, enter quickly from a rear door, if possible, to keep the temperature warm on the front seat floorboards. The trunk should also be measured if the air temperature in the trunk can be raised to 70°F.

   When monitoring the car, make sure the Jerome is at roughly the same temperature as the interior of the car.

5. Sketch an approximate floor plan of the house (to scale as best as possible). Also, sketch the approximate layout of each room, including furniture. Record the location of detectable and non-detectable mercury readings on the room sketch.

6. Note the presence of any porous building materials such as ceiling tiles, exposed insulation, or masonry (cinder block) walls.

7. Note the presence of any fluorescent lamps, chlorine bleach, or other potentially mercury bearing items in the home.

8. Determine the occupation of all residents of the home.

9. When monitoring bathroom areas, note the existence of any mercury thermometers. Do not conduct a search, however.

10. Note the general housekeeping practices (messy vs. neat, clean vs. dirty). Record any positive or negative comments made or any questions asked. Answer all technical questions to the best of your ability. Be factual and do not guess. Follow-up immediately on any questions you cannot answer when in the home.

11. Describe the floor and wall coverings in each room. Are the floors wood, linoleum, tile, covered with rugs or carpet?

Are the walls panelled, wall papered, or painted, are the walls/ceilings constructed of wall board or plaster?

12. Record location of all physical samples (not air readings) collected. Give a receipt for all items removed from a home.

13. Note the types and location of all heating systems.

DOCUMENTATION

Record all observations in a bound field notebook, number all pages sequentially. Use an indelible ink for all notations. Mark through all corrections with one single horizontal line; do not erase or black out. Initial all corrections and record date and time.

Before leaving the home make sure all notes are legible. Give the homeowner a receipt for any items removed from the home.

Site:
Break: 11.1
Other:

EPA/Olin Meeting 2/16/89

Name	Organization	Phone No.
Shane Hitchcock	EPA	404/347-3931
Mike Carter	"	404/546-3117
Milton L. Norsworthy	EPA	615-336 4212
M S Davenport	EPA	615-336-4299
VERRILL NORWOOD	OLIN	615-336-4395
Reuben Bussey	EPA-ORC	(404) 347-2641
Danny France	EPA-ESD	(404)-546-2207
Chuck PAETROSCWICZ	ATSDR	404.347.3931
Bob Jourdan	EPA	404/347-3931
Jan B Rogers	EPA	404/347-3931
Jim Kopotic	EPA	404/347-3931

2-28-89

Site:
Break: 11.9
Other:

To: Jan Rogers

From: Jim Kopotic (904/599-2467)

Olin Study

7 pages including cover

RUSH

2-28-89

To: Jan Rogers

From: Jim Kopotic (904/599-2467)

Qin Study

7 pages including cover

Rush

Milton L. Norsworthy
Plant Manager
Olin Corporation
Lower River Road
Charleston, Tn. 37310

Re: Olin/Yeargin Mercury Release
US-EPA Administrative Order No. 88-34-C

Dear Mr. Norsworthy:

As discussed during the meeting conducted at the US-EPA office on February 16, 1989, twenty five homes exceeded the recommended ambient level of 0.5 µg/m³ for mercury as determined by the sampling investigation conducted by US-EPA during November and December 1988. The names and addresses of the employees provided in the US-EPA Sampling report (draft) and the Yeargin employee roster that were provided to you during that meeting will need to be decontaminated pursuant to Administrative Order 88-34-C. As requested I have included as an attachment a list of those homes that exceeded the recommeded 0.5 µg/m³

In addition action level. Those homes not sampled by US-EPA will need to be addressed by Olin during the cleanup activities. The number preceeding the employee's name was taken from the Yeargin employee roster provided by Yeargin Construction Company. The employees address is also provided on the roster which has been attached. Upon completion of the internal review procedures a copy of the final US-EPA report will be mailed to you.

I look forward to receiving Olin's final work plan for cleaning the contaminated homes. If you should have any questions I can be reached at 404/347-3931. In my absence from the office, Bob Jourdan should be contacted.

Sincerely,

James Kopotic
On-Scene Coordinator

ATTACHMENT 1

Homes exceeding 0.5 μg/m³:

(b)(6) Personal Privacy

[redacted]

37
15
19
51
35
42
44
4
9
49
7
22
28
34
41
2
53
1
47
14
20
11
24
38
32

Provided by Yeargin Const. Co.

	Name	Classification
1.	Beasley, Grady E. (Gene)	Pipefitter
2.	Bradley, Wayne H.	Pipefitter
3.	Brown, Mike D.	Utility Worker
4.	Bunch, Jerry V.	Insulator
5.	Carroll, Tommy J.	Pipefitter
6.	Caudill, Walter T.	Ironworker
7.	Chapmen, Michael W.	Reinforcing Iron
8.	Cline, Denver P.	Millwright
9.	Coleman, Choe R.	Pipefitter
10.	Dalton, Monty K.	Pipewelder
11.	Derrick, William R. (Bill)	Millwright
12.	Dilbeck, Jim J.	Pipefitter
13.	Dixon, Phillip O. (Phil)	Pipefitter
14.	Gennoe, Randall E.	Pipe Helper
15.	Goins, James W.	Millwright
16.	Gourley, Billy K.	Utility Worker
17.	Green, Alfred E.	Millwright
18.	Hamby, George L.	Pipefitter
19.	Harris, Christopher S. (Chris)	Mason Helper
20.	Hicks, Kenneth L.	Insulator Helper
21.	Hood, Franklin F.	Pipe Helper

(b)(6) Personal Privacy

[redacted]

22.	Hooper, Jeffery D.	Pipe Helper
23.	Hooper, Tommy D.	Pipefitter
24.	Key, Robert J.	Insulator Foreman
25.	Knox, Jesse G. (Glen)	Pipe Gen. Foreman
26.	Lewis, Larry J.	Millwright
27.	Martin, David P.	Pipefitter
28.	Martin, Kenny R.	Pipefitter Foreman
29.	Martin, Marshal M.	Utility Worker
30.	Martin, Marvin D. (Dwight)	Pipefitter
31.	Meadows, Doyle P.	Pipefitter
32.	Murphy, Douglas Todd (Todd)	Ironworker
33.	Near, Danny F.	Insulator
34.	Queen, Allen R.	Iron Worker
35.	Rayburn, George R.	Pipefitter
36.	Sharpe, Ronald R. (Ron)	Pipefitter
37.	Shaw, Vincent K. (Keith)	Pipefitter
38.	Sisemore, Tim R.	Superintendent
39.	Skipper, James D. (Chuck)	Pipefitter
40.	Smith, Bradley M. (Brad)	Utility
41.	Smith, Charles W. (Wayne)	Pipefitter
42.	Smith, James G. (Greg)	Pipe Helper
43.	Snider, Edwin S. (Ed)	Millwright

(b)(6) Personal Privacy

[redacted]

44.	Stephens, Edward R. (Ed)	Pipefitter
45.	Taylor, Darrell D.	Pipewelder
46.	Tomlin, Garry C.	Pipe Helper
47.	Trusley, Michael D.	Utility Worker
48.	Webb, Randall K. (Caid)	Insulator Helper
49.	Wilson, John D.	Pipefitter
50.	Wilson, Mark P.	Insulator Helper
51.	Wilson, Sherrell A.	Pipe Foreman
52.	Yearwood, Tim Carl	Millwright Foreman
53.	Young, Larry S.	Pipefitter

(b)(6) Personal Privacy

[redacted]

Site:
Break: 2.4
Other:

Page 1

1) Homeowners to be notified in advance of cleanup operation activities in writing. Copy of letters to be sent to Jim Kopotic (EPA). Mr. Kopotic can be listed on letter as a contact for the homeowners should they have any questions.

Page 2

Olin Responsible For:

Add #4 — Provide results to EPA/OSC with 48 hrs. following post cleanup air sampling. Issue report on cleanup within 60 days following completion of cleanup activities.

EPA Responsible For:

#1. Providing names/list of those homes not sampled by EPA in addition to those exceeding 0.5 µg/m³.

#2. EPA will overview ERM's cleaning & sampling activities.

ERM Responsible For:

#2. Provide trained cleanup personnel, and supervise their activities during the cleanup.

#5. ERM will attempt to locate and sample their homes.

Page 3

PERSONNEL AND QUALIFICATIONS

3. ERM person should not be referred to as an OSC. The term On-Site Coordinator (OSC) is a term used by the Government to describe responders as ~~po~~ promulgated in the National Contingency Plan (NCP). EPA would prefer the term "Project Manager."

Page 7

Need to include a chemical description of $Hg X$.

Washing Machine — discharge will be collected and disposed of at Olin's Charleston facility.

Page 8

The laundry to be used to decon the clothing needs to be clarified (elaborate).

Vacuum Cleaners — What parts will be replaced?

Page 9

Olin will notify homeowner of mercury levels found in the home.

Once study is complete EPA will review data for compliance with A.O.

Suggestions

1). Olin screen cleanup contractor personnel.

2) Replace vacuum cleaners and washing machines.

BLANK PAGE

Site:
Break: 2.2
Other:

DRAFT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA 30613

10008246

MEMORANDUM

DATE: November 8, 1988

SUBJECT: Air monitoring results from Mercury screening of Olin construction worker's homes

FROM: Danny France DANNY
Air Compliance Section

TO: Bob Jourdon, Section Chief
Emergency Response and Control Section
Waste Management Division

We have enclosed the results from the air toxics monitoring that we performed in the Charleston, Tennessee area last week. We monitored in six of the homes of construction workers who were exposed to high levels of mercury at the Olin Chemical Plant (located near Charleston, Tennessee). Jim Kopotic of your section and Chuck Pietrosewicz of ATSDR observed the monitoring and analysis and conducted interviews of the people who had been exposed and their families.

In general, we found either no detectable concentrations of mercury or only extremely low concentrations of mercury in the ambient air inside of the homes. However, we did find some hot spots inside the homes where clothing worn at the Olin plant had been stored, inside work vehicles, inside washing machines that were used to launder work clothes, etc. Even these areas however only had low level contamination. If you have any questions about this report please feel free to call either Jerry Burger or myself at FTS-250-2207

cc: Mike Carter
Doug Lair
Jim Finger
Chuck Pietrosewicz
Jim Kopotic

Provided by ESD

OLIN CHEMICAL MERCURY STUDY

U.S. EPA
REGION IV

ENVIRONMENTAL SERVICES DIVISION
COLLEGE STATION ROAD
ATHENS, GEORGIA

Olin Chemical Mercury Study
Charleston, Tennessee

INTRODUCTION

In response to a request from the Emergency Response and Control Section of the Waste Management Division, the Environmental Services Division screened six houses (located near the Olin Chemical plant in Charleston, Tennessee) for possible mercury contamination during November 2-4, 1988.

BACKGROUND

Approximately three months ago employees of a contractor hired by Olin Chemical were contaminated by mercury while replacing some pipes and fittings in one of the cell houses at the Olin Chemical plant. The construction workers were using cutting torches to cut through pipes containing elemental mercury. They used only cartridge type respirators and disposable Tyvek suits that were supplied by the company as safety gear. This proved to be inadequate to prevent their exposure to the intense concentrations of mercury vapors created during the pipe cutting. According to workers interviewed there were large amounts of mercury left in the pipes that were cut -- often there was so much mercury that they would have to notch the top of the pipes and heat the mercury to the boiling point to volatilize it before the pipes could be heated enough to cut. According to other worker accounts the superheated mercury would actually rise to the top of the cell house and condense falling back to the floor in fine droplets of mercury "rain". There it would form puddles of mercury in the cell house floor. After exposure to these conditions, the construction workers reported that they were refused use of the Olin facility showers before leaving the work site.

Thirty of the construction workers exposed to these extremely high levels of mercury have been diagnosed as having mercury poisoning. Many of these are currently undergoing chelation therapy at the Vanderbilt Medical Center. The Tennessee Occupational Safety and Health Administration has done extensive monitoring for mercury as well as doing surveys of the construction workers that were involved. Since the worker exposure was so intense and the workers did not remove contaminated clothing or cleanup prior to leaving the site, the Emergency Response and Control Section requested that the Environmental Services Division screen for mercury in several of residences of the construction workers to assure that their families were not being exposed to hazardous concentrations of mercury.

OBJECTIVE

The objective of this study was to determine if there are hazardous levels of mercury in the air in the residences of the construction workers that are currently undergoing treatment for mercury poisoning. In addition an attempt was made to determine if there are concentrated hot spots of mercury contamination in the home that could result in pathways of exposure other than air.

STUDY AREA

The residences of the construction workers involved were located in four counties around the Olin plant. The locations of the six houses that ESD monitored are shown in Table 3.

SAMPLING PLAN

At each house an eight hour sample was taken using Jerome dosimeter tubes and an Alpha battery powered sampling pump. In addition to the eight hour samples taken with the dosimeter tubes, several instantaneous readings were taking using the Jerome model 511 Hg analyzer. The purpose of the instantaneous readings was to determine if there were any hot spots of mercury contamination in the house while the purpose of the eight hour samples was to determine if there were in concentrations of mercury in the ambient air inside the house that could be hazardous.

The dosimeter tubes were connected to the battery powered Alpha sampling pumps and adjusted to a flow rate of approximately 20 cc/min. Sampling continued for eight hours. At the end of the sample period the dosimeter tubes were retrieved and attached to a power supply, an internal heater inside the dosimeter tube was activated which liberated any trapped mercury and the liberated mercury was analyzed by the Jerome model 511 Hg analyzer.

The instantaneous readings were performed by allowing the Jerome model 511 Hg analyzer to run through it's 2 minute sampling cycle while drawing an air sample with an internal pump from a 3 foot line of Tygon tubing. Samples were taken at the locations shown in Table 1.

ANALYTICAL PLAN AND QUALITY ASSURANCE

All samples were either analyzed on-site (instantaneous readings) or in a van (dosimeter samples) that has been modified to serve as a mobile lab. Instrument and flowrate calibrations were performed in the mobile lab as well.

The Jerome model 511 Hg analyzer was calibrated prior to analysis and after the second day of analysis. All battery powered Alpha sample pumps were calibrated against an NBS tracable flowmeter before and after sampling. The Jerome model 511's internal pump was calibrated against an NBS tracable flowmeter before and after the sampling.

RESULTS

All results are shown in Tables 1 and 2. Readings showed low concentrations at most locations throughout the homes. However, some hot spots (such as washing machines, work boots and vehicle interiors) were located. To remove the last vestiges of mercury these should be cleaned up and/or removed from the homes.

RESULTS

All results are shown in Tables 1 and 2. Readings showed low concentrations at most locations throughout the homes. However, some hot spots (such as washing machines, work boots and vehicle interiors) were located.

The 2-minute instanteous readings were generally less than 10ug/M3. However, several values ranged from 10.2 ug/M3(inside work truck) to 53.8 ug/M3 (over one washing machine tub). Other elevated values were observed in a plastic bag containing work boots (19.9 ug/M3) as well as over two other washing machines (11.3 and 19.4 ug/M3). The NIOSH 10-hour time weighted average mercury exposure limit is 50 ug/M3.

The 8-hour composite air samples collected from the general living areas of the six residences were low ranging from 1.0 ug/M3 to 5.0 ug/M3.

TABLE 1

Olin Chemical
Mercury Study
Screening of Workers Homes

Hg Readings
2 minute samples
with Jerome Model 511 Analyzer

Residence	Date	Time	Location	HG Vapor $\mu g/M^3$
(b)(6) Personal Privacy	11/2/88	1:15 pm	living room	mdl
		1:20 pm	kitchen table	mdl
		1:25 pm	kitchen sink	mdl
		1:30 pm	over washing machine tub (lid open)1/	2.7
		1:35 pm	work boots in plastic bag	19.9
		1:39 pm	inside truck on driver's side	10.2
(b)(6) Personal	11/2/88	3:56 pm	1' over living room carpet	mdl
		4:00 pm	kitchen counter next to sink	4.3
		4:03 pm	over kitchen sink2/	5.9
		4:06 pm	over washing machine tub (lid open)1/	11.3
		4:09 pm	bathroom sink in master bedroom	7.0
		4:13 pm	tool room	4.3
		4:16 pm	over open tool box	5.4
		4:20 pm	over open tool bucket	11.8
		4:29 pm	inside Ford Bronco on drivers side	8.1
(b)(6) Personal Privacy	11/3/88	10:23 am	living room chair	mdl
		10:25 am	living room chair under cushion	mdl
		10:31 am	1" over carpet bathroom master BR	2.2
		10:34 am	over shower drain in bathroom	2.2
		10:37 am	6" over bed in master bedroom	mdl
		10:40 am	vacuum cleaner hose	2.2
		10:46 am	inside truck above seat—driver's side	3.2
		10:49 am	inside truck above floor—driver's side	3.8
		10:52 am	over washing machine tub (lid open)1/	19.4
		10:55 am	inside spare work boots	mdl

1/ capped bottle of bleach nearby

2/ capped bottle of cleanser nearby

mdl= $2 \mu g/M^3$

NIOSH Exposure Limit = $50 \mu g/M^3$ 10 hr. time weighted avg.

TABLE 2

Olin Chemical
Mercury Study
Screening of Workers Homes

Hg Readings
8 Hr. Sample With Dosimeter Tubes
Analyzed With Jerome Model 511 Analyzer

Residence	Date	Time	Location	HG Vapor $\mu g/M^3$
(b)(6) Personal Privacy	11/2/88	1:11 pm – 6:15 pm	living room	1.6
	11/2/88	3:47 pm – 11:47 pm	living room/kitchen	5.0
	11/2/88	9:29 am – 4:03 pm	living room	2.4
	11/2/88	10:27 am – 5:26 pm	living room	2.1
	11/2/88	1:07 pm – 9:07 pm	den/kitchen	1.0
	11/2/88	3:22 pm – 11:22 pm	bedroom	1.1

mdl= 0.5 $\mu g^3/M$

NOTE: MDL is lower with dosimeter tube samples because of larger air volume samples

TABLE 3

Olin Chemical
Mercury Study
Screening of Workers Homes

U.S. EPA

Addresses of Homes Monitored

Choe Colman
(b)(6) Personal Privacy
[redacted]

George Rayburn
(b)(6) Personal Privacy
[redacted]

Vincent Shaw
(b)(6) Personal Privacy
[redacted]

Wayne Bradley
Billy Gourley
(b)(6) Personal Privacy
[redacted]

Sherrell Wilson
(b)(6) Personal Privacy
[redacted]

Allan Queen
(b)(6) Personal Privacy
[redacted]

BLANK PAGE

Site: _____
Break: 2.1
Other: _____

REGION IV INCIDENT NOTIFICATION REPORT

1. Case No.: _____

2. Reported: (mm/dd/yy) 10/24/88 | 3. Time: 1130 | Recorded By: Kopotic

4. [x] Through NRC: | 5. NRC Case No.: | 33. Spill Date: 8/22/88 | 34. Spill Time: redact shay address RH

A. REPORTER

6. Reported By: (b)(6) Personal Privacy [redacted]
7. Organization Name: (b)(6) Personal Privacy [redacted]
8. Organization: [ ] 9. discharger [ ] 10. public [ ] 11. state [ ] 12. local [ ] 13. federal
14. Address: (b)(6) Personal Privacy [redacted]
15. City: [redacted] | 16. County: | 17. State (b)(6) Personal [redacted]
18. Zip: [redacted] | 19. Phone (b)(6) Personal Privacy [redacted]

B. DISCHARGER

20. [ ] As Above in A if 9 applies | 21. Name: Olin Chemical Corp.
22. Address: Lower River Rd.
23. City: Charleston | 24. County: | 25. State Tn
26. Zip: 37310 | 27. Phone: (615) 336-4511

C. INCIDENT LOCATION

28. [x] As Above in B | 29. Street or Approx. Location: 812 Cell Bldg. - Olin Plant
30. City: | 31. County: | 32. State

E. MATERIAL

Material: [ ] oil [ ] hazardous substance [ ] other | 35. Material [ ] Unknown

	UN/DOT No	CAS No.	CHRIS Code	Quantity Spilled	Amount Entered	Units (Circle 1)	> RQ
36. Mercury	37.	38.	39.	40.		41. lb. gal. bbl. oth	[ ]
42.	43.	44.	45.	46.		47. lb. gal. bbl. oth	[ ]
48.	49.	50.	51.	52.		53. lb. gal. bbl. oth	[ ]

G. MED.

Medium Affected: [x] 63. air [x] 64. land [ ] 65. water [ ] 66. groundwater [ ] 67. within facility only

68. Waterway Affected: | Tributary To:

10008260

F. SOURCE

Source of Spill: [ ] 54. highway [ ] 55. air transport [ ] 56. railway [ ] 57. vessel [x] 58. fixed facility [ ] 59. pipeline [ ] 60.

62 & 76. Description:

H. CAUSE

Reported Cause: [ ] 69. transportation accident [ ] 70. equipment failure [ ] 71 operational error [ ] 72. natural phenomenon [ ] 73. dumping [ ] 74. unknown [ ] 75. other

I. DAM

Damages: 77. no. of injuries _____ 78. no of deaths _____ [ ] property damage > $50,000

J. ACTIONS

80. [ ] Evacuation | 81. Response Action Taken:

K. NOTIFIED

Caller Has Notified: [ ] 82. state/local [ ] 83. discharger [ ] 84. USCG [ ] 85. other [ ] 86. unknown

Agency Name

L. COMMENTS

87. Comments (b)(6) Personal Privacy [redacted] was employed by Yeargin, Inc. who was contracted by Olin to replace pipes in facility. While working in 812 Cell Bldg. (b)(6) Personal Privacy [redacted] was exposed to mercury, as was the other crew members. (b)(6) Personal [redacted] claimed there is 27 families that have been exposed to mercury from the job (b)(6) Personal Privacy [redacted] transported mercury from [x] Additional Information

M. REGIONAL DATA FIELDS

Responding Agency: [ ] state [ ] local [ ] discharger [ ] federal [ ] EPA [ ] TAT [ ] unknown

Agency Name:

Responder (Contact):

EPA has notified: [ ] state [ ] local [ ] USCG [ ] RRT [x] referral (see Section N)

N. ENFORCEMENT

CWA: 308 [ ] o [ ] c; 308c [ ] o [ ] c | CERCLA: 103c [ ]; 104 [ ] | None: [ ]

Referred to: NPDES [ ] TSCA [ ] WATER [ ] FEDFAC [ ] RCRA [ ] OTHER ATSDR

the plant to his residence. (b)(6) Personal Privacy state Tn-OSHA conducted an investigation at his home and mercury vapor was detected in his carpet, floors, washer, truck, lunch box, etc. (b)(6) Personal Privacy stated that when he got home from work that he found elemental mercury in his pants pockets. He is seeing Andrew Heath, MD, at the Region Middle Tn. Toxicology Center (615/343-6280) about his medical condition.

Note: Contact for Tn-OSHA that conducted investigation is
Norman Elkins – Chattanooga, Tn.
615/634-6408

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Site:
Break: 2.1
Other:

SUPERFUND RECORD OF COMMUNICATIONS

SITE OLIN-YEARGIN-MERCURY
COUNTY _____ STATE TN

CHECK APPROPRIATE BLOCK(S)

- ☐ INCOMING PHONE CALL
- ☒ OUTGOING PHONE CALL
- ☐ CONFERENCE PHONE CALL
- ☐ MEETING/ CONFERENCE
- ☐ VISIT
- ☐ ASSIGNMENT

- ☒ EMERGENCY/IMMEDIATE
- ____ REMEDIAL

- ☐ HEALTH CONSULTATION
- ☐ SITE VISIT
- ☐ REVIEW DATA
- ☐ PUBLIC MEETING
- ☐ WORKER HEALTH & SAFETY
- ☐ OTHER (Specify)

Redact

DATE 4/14/89 | TIME 10:30-10:15 | PHONE NO (Include Area Code) 6153343502

TO (Name, Agency, Firm, and Address)
Record.

ROUTING
ATSDR/OEA
ATSDR/OHA.
J. Kopotic - EPA ✓

FROM (Name, Agency, Firm, and Address)
Chuck Pietrosewicz

SUMMARY
This am, @ request of EPA OSC returned call to above citizen (Decatur, TN) who's family in late '88 rented home from a worker who had been exposed to Hg in summer '88 incident @ Olin Corp in Athens, TN.

Family concerned that young child who had been sick (GI problems) may have been due to Hg exposure in home, even though home had been decon'd 2x by Olin Contractor. Advised wife [redacted] that her level of concern was unfounded & referenced urine sample results of homeowners previously tested by TDHE & ATSDR. that were all c/in reference range. [redacted] just had child's urine tested for Hg upon advice of personal MD; Results ⊖

[redacted] level of concern now lessened & she not desirous of additional testing or [redacted]ormation.

ACTION REQUIRED INFORMATION OR MA[redacted]OVIDED ETC ENCLOSURE(S) INCLUDED ____ YES ____ NO

10103774

TYPED NAME & SIGNATURE
Chuck Pietrosewicz

DATE 4/14/88

CDC 80.9 (Formerly 40 4)
REV. 6/84

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2 4 0036

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

File: 2.4
16058

MAR 2 3 1989

Phil Newman
Olin Corporation
P.O. Box 248
Lower River Road
Charleston, Tennessee 37310

Re: Olin/Yeargin Mercury Release
U.S. EPA Administrative Order No. 88-34-C

Dear Mr. Newman:

As previously discussed during our telephone conversation on March 16, 1989 the following addresses the final work plan and your questions regarding the cleanup of homes.

- US-EPA concurs with the cleanup work Plan (final).

- US-EPA and the Tennessee Department of Health and Environment will not require any special permits or licensed waste hauler, to transport the contaminated materials resulting from the cleanup of homes, to the Olin facility in Charleston Tennessee for disposal in the RCRA permitted waste landfill.

- The Jerome meter 431 is acceptable for analyzing the dosimeter tubes.

- US-EPA has no objection to collecting a dosimeter tube prior to cleaning a home. Following cleanup, a dosimeter tube will be collected to ensure that the mercury contamination has successfully been removed to the recommended safe level (0.5 ug/m^3 or less).

- The list of twenty-five homes to be cleaned is included in this letter (attachment 1). Those homes not sampled by US-EPA during the sampling investigation conducted during November and December, 1988 are included in this letter (attachment 2). Those homes not sampled by US-EPA will need to be addressed by Olin during the cleanup activities.

I have included a copy of the Yeargin employee roster that will provide the employee's telephone numbers and addresses. Should you have any other questions, I can be reached at the Holiday Inn, Athens, Tennessee at 745-1212, or you can contact my supervisor Mr. Bob Jourdan at 404/347-3931.

Sincerely yours,

for James Kopotic
On-Scene Coordinator

ATTACHMENT 1

Homes exceeding 0.5 ug/m^3:

(b)(6) Personal Privacy

[redacted]

37
15
19
51
35
42
44
4
9
49
7
22
28
34
41
2
53
1
47
14
20
11
24
38
32

ATTACHMENT 2

Homes not sampled by US-EPA:

10 (b)(6) Personal Privacy - was not located
12 - " " "
13 - " " "
45 - " " "
29 - Did not want EPA to survey home.
30 - " " " " " " "

Note: Residence # 16 (b)(6) Personal Privacy same as # 2 (b)(6) Personal Privacy
and # 23 (b)(6) Personal Privacy same as # 22 (b)(6) Personal Privacy

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TND003337292

OLIN CHEMICALS/GRP CHAS PLT

Responsive

Removal Site

Administrative Record

Volume I

Region IV
Waste Management Division
U.S. Environmental Protection Agency

TND003337292

OLIN CHEMICALS/GRP CHAS PLT

Removal Site Administrative Record

Volume I

As of January 29, 1991

Prepared for

Region IV
Waste Management Division
U.S. Environmental Protection Agency

With Assistance from

LABAT-ANDERSON, INCORPORATED
2200 Clarendon Boulevard, Suite 900 ■ Arlington, Virginia 22201 ■ (703) 525-5300

INTRODUCTION

This document is the Index to the Administrative Record for the OLIN CHEMICALS/GROUP CHARLESTON, TENNESSEE PLANT REMOVAL SITE.

The Administrative Record is available for public review at EPA Region IV's Office in Atlanta, Georgia and at the E.G. FISHER PUBLIC LIBRARY, 106 HORNSBY STREET, ATHENS, TN 37303

Questions concerning the Administrative Record should be addressed to the EPA Region IV On-Scene Coordinator.

The Administrative Record is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Due to the CONFIDENTIAL nature of the material portions of certain documents contained in this Administrative Record have been withheld.

OLIN CHEMICALS/GRP CHAS PLT
REMOVAL SITE ADMINISTRATIVE RECORD

Table of Contents

Volume I

Administrative Record Index

Section I: Site-Specific Documents
Section II: Key Word in Citation Index
Section III: Chronological Listing
Section IV: Guidance Documents

2.0 REMOVAL RESPONSE

2.1 Correspondence
2.2 Sampling and Analysis Data
2.4 Work Plans and Progress Reports
2.8 Removal Response Reports

10.0 ENFORCEMENT

10.11 EPA Administrative Orders

13.0 COMMUNITY RELATIONS

13.7 News Clippings and Press Releases

17.0 SITE MANAGEMENT RECORDS

17.7 Reference Documents
17.8 State and Local Technical Records

TND003337292

OLIN CHEMICALS/GRP CHAS PLT

Removal Site

Administrative Record

Index

Region IV
Waste Management Division
U.S. Environmental Protection Agency

Section I

Site-Specific Documents

ADMINISTRATIVE RECORD INDEX

for the

OLIN CHEMICALS/GRP CHAS PLT Removal Site

2.0 REMOVAL RESPONSE

2.1 Correspondence

1. EPA Region IV Incident Notification Report (October 24, 1988). This report concerns the August 22, 1988 Mercury release at the Olin Chemical Company, Charleston, Tennessee. Due to the CONFIDENTIAL nature of the material, portions of this report has been withheld.

2.2 Sampling and Analysis Data

The Sampling and Analysis Data for the Olin Yeargin Mercury Release may be reviewed, by appointment only, at EPA Region IV, Atlanta, Georgia.

1. Memorandum from Steven L. Edwards, OSHA, to Michael Buczynski, OSHA (December 5, 1988). A letter concerning Hopcalite Analytical Procedure for Mercury analysis.

2. Herbert Barden, EPA Region IV, to Jim Kopotic, EPA Region IV (April 7, 1989). A transmittal of the "Final Report: Olin Chemical Mercury Study, November and December 1988," EPA Region IV.

3. "Final Report: Olin Chemical Mercury Study, November and December 1988," EPA Region IV (April 7, 1989).

4. Letter from Tony E. Chatman, ERM-Southeast, Inc., to Jim Kopotic, EPA Region IV (April 25, 1989). A letter transmitting a summary of the dosimeter analysis for Mercury levels in the Yeargin employees homes, data attached. Due to the CONFIDENTIAL nature of the material, portions of this report has been withheld.

2.4 Work Plans and Progress Reports

1. Letter from M. L. Norsworthy, Olin Chemical, to Greer C. Tidwell, EPA Region IV (March 2, 1989). A letter transmitting the "Protocol for Monitoring and Cleaning Homes," ERM-Southeast, Inc. and requesting attachments for the work plan.

2. "Protocol for Monitoring and Cleaning Homes," ERM-Southeast, Inc. (March 2, 1989).

3. Letter from Jim Kopotic, EPA Region IV, to Phil Newman, Olin Corporation (March 20, 1989). A letter concerning final work plan and transmitting attachments for the final work plan. Due to the CONFIDENTIAL nature of the material, portions of this report has been withheld.

2.8 Removal Response Reports

1. Incident-Specific Regional Response Team Activation: In the matter of the Olin Yeargin Mercury Release (November 18, 1988). Including meeting agenda and site background information. Due to the CONFIDENTIAL nature of the material, portions of this report has been withheld.

2. Minutes of the Regional Response Team meeting in the matter of the Olin Yeargin Mercury Release (November 18, 1988).

3. Letter from Patrick A. Turri, State of Tennessee Department of Health and Environment, to Barry L. Johnson, Agency for Toxic Substances and Disease Registry (December 2, 1988). Request for EPA Region IV assistance in conducting a survey of the homes of exposed workers and evaluation of specimens.

4. Letter from Mark A. Bashor, Agency for Toxic Substances and Disease Registry, to Patrick A. Turri, State of Tennessee Department of Health and Environment (January 17, 1989). Outlining the sampling and analysis work conducted by the Agency for Toxic Substances and Disease Registry as requested by the State of Tennessee Department of Health and Environment.

2.8 Removal Response Reports (cont'd.)

5. Memorandum from Richard R.Hammel, National Institute of Occupational Safety and Health, and Stanley A. Salsbury, National Institute of Occupational Safety and Health, to Wendy Kaye, Agency for Toxic Substances and Disease Registry (March 20, 1989). A summary of the mercury release incident at Olin Chemical Company, Charlestown, Tennessee, and recommended changes to be instituted at the Olin facility.

6. Memorandum from Doug Lair, EPA Region IV, to Jim Kopotic, EPA Region IV (April 26, 1989). Transmitting National Pollutant Discharge Elimination System, Resource Conservation and Recovery Act and Air Compliance inspection reports.

7. Memorandum from Kenneth G. Orloff and Bonnie S. Richter, Agency for Toxic Substances and Disease Registry, to Chuck Pietrosewicz, Agency for Toxic Substances and Disease Registry (May 4, 1989). A Memo concerning Mercury Contamination of indoor air in private residences, Charleston, Tennessee.

8. "Cleaning of Certain Yeargin Employee's Homes," ERM-Southeast, Inc (August 17, 1989). A report detailing the testing and cleaning of Yeargin workers homes following the Mercury Release at the Olin Chemical Company, Charlestown, Tennessee.

9. "Final Report: Technical Assistance to the Tennessee Department of Health and Environment, Mercury Exposure Study, Charleston, Tennessee," Agency for Toxic Substances and Disease Registry (December 1990).

10.0 ENFORCEMENT

10.11 EPA Administrative Orders

1. Administrative Order, In The Matter Of: Olin Mercury Spill, Charleston, Tennessee, Olin Corporation, Lower River Road, Charleston, Tennessee 37310, Respondent. EPA Docket No.: 88-34-C (December 16, 1988).

2. Letter from Maurice Davenport, Olin Chemical Company, to Greer C. Tidwell, EPA Region IV (January 10, 1989). A letter acknowledging receipt of Administrative Order No. 88-34-C and state Olin Company's intent to comply, while denying that it is liable under Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601.

13.0 COMMUNITY RELATIONS

13.7 News Clippings and Press Releases

1. "Cleanup of Mercury contaminated homes begins March 20 in Charleston, Tennessee," Environmental News (March 20, 1988).

17.0 SITE MANAGEMENT RECORDS

17.7 Reference Documents

1. "Review of National Emission Standards for Mercury," EPA (DATE UNKNOWN).

2. Mercury Fact Sheet (DATE UNKNOWN).

3. Facility information, Olin Corporation - TND003337292, Lower River Road, Charleston, Tennessee 37310 (1985).

4. "Material Safety Data Sheet," Action Technologies, Inc (September 1985).

5. "Cleanup of Mercury Contamination of Thermometer Workers' Homes," John Zirschky and Linden Witherell, Journal of the American Industrial Hygiene Association (January 1987).

6. "Superfund and Contamination of Workers' Homes;" J. Zirschky, B. Gentry and P. Marcus; Journal of the American Industrial Hygiene Association (November 1987).

7. E-812 Chlorine Plant Shutdown August 22, 1988, provided by Olin Chemical Company, Charlestown, Tennessee (August 22, 1988). Objectives of Shutdown Olin Chemical Company, Charlestown, Tennessee.

8. Memorandum from William R. Davis, EPA Region IV, to Jim Kopotic, EPA Region IV (July 10, 1989). Concerning TVA Fish Tissue Review relative to the Olin Chemical Company, Charlestown, Tennessee.

17.8 State and Local Technical Records

1. "Report on Potential Hazardous Waste Disposal Facility," State of Tennessee Department of Public Health (May 20, 1982).

Section II

KEY WORD IN CITATION INDEX

	DOCUMENT DESCRIPTION	BREAK	DATE
Letter from Mark	**A.** Bashor Agency for Toxic Substances and Disease	2. 8	01/17/89
Health and Stanley	**A.** Salsbury National Institute of Occupational Saf	2. 8	03/20/89
etter from Patrick	**A.** Turri State of Tennessee Department of Health a	2. 8	12/02/88
egistry to Patrick	**A.** Turri State of Tennessee Department of Health a	2. 8	01/17/89
Safety Data Sheet	**Action** Technologies Inc | Material Safety Data Sh	17. 7	09/01/85
onal Response Team	**Activation** In the matter of the Olin Yeargin Mercu	2. 8	11/18/88
	Administrative Order In The Matter Of Olin Mercury	10.11	12/16/88
alth to Wendy Kaye	**Agency** | Memorandum from Richard R.Hammel Nationa	2. 8	03/20/89
o Barry L. Johnson	**Agency** for Toxic Substances and Disease Registry |	2. 8	12/02/88
Bonnie S. Richter	**Agency** for Toxic Substances and Disease Registry |	2. 8	05/04/89
arleston Tennessee	**Agency** for Toxic Substances and Disease Registry |	2. 8	12/01/90
rom Mark A. Bashor	**Agency** for Toxic Substances and Disease Registry t	2. 8	01/17/89
Bonnie S. Richter	**Agency** for Toxic Substances and Disease Registry t	2. 8	05/04/89
ell Journal of the	**American** Industrial Hygiene Association | Cleanup	17. 7	01/01/87
cus Journal of the	**American** Industrial Hygiene Association | Superfu	17. 7	11/01/87
l Report Technical	**Assistance** to the Tennessee Department of Health a	2. 8	12/01/90
Industrial Hygiene	**Association** | Cleanup of Mercury Contamination of	17. 7	01/01/87
Industrial Hygiene	**Association** | Superfund and Contamination of Work	17. 7	11/01/87
ine Plant Shutdown	**August** 22 1988 provided by Olin Chemical Company C	17. 7	08/22/88
Homes J. Zirschky	**B.** Gentry and P. Marcus Journal of the American In	17. 7	11/01/87
Herbert	**Barden** EPA Region IV to Jim Kopotic EPA Region IV	2. 2	04/07/89
and Environment to	**Barry** L. Johnson Agency for Toxic Substances and D	2. 8	12/02/88
etter from Mark A.	**Bashor** Agency for Toxic Substances and Disease Reg	2. 8	01/17/89
contaminated homes	**begins** March 20 in Charleston Tennessee Environmen	13. 7	03/20/88
neth G. Orloff and	**Bonnie** S. Richter Agency for Toxic Substances and	2. 8	05/04/89
ds OSHA to Michael	**Buczynski** OSHA | Memorandum from Steven L. Edward	2. 2	12/05/88
Chemical to Greer	**C.** Tidwell EPA Region IV | Letter from M. L. Nors	2. 4	03/02/89
l Company to Greer	**C.** Tidwell EPA Region IV | Letter from Maurice Da	10.11	01/10/89
Cleaning of	**Certain** Yeargin Employee's Homes ERM-Southeast Inc	2. 8	08/17/89
2 Lower River Road	**Charleston** Tennessee 37310 | Facility information	17. 7	01/01/85
n Lower River Road	**Charleston** Tennessee 37310 Respondent. EPA Docket	10.11	12/16/88
ury Exposure Study	**Charleston** Tennessee Agency for Toxic Substances a	2. 8	12/01/90
begins March 20 in	**Charleston** Tennessee Environmental News | Cleanup	13. 7	03/20/88
Olin Mercury Spill	**Charleston** Tennessee Olin Corporation Lower River	10.11	12/16/88
n Chemical Company	**Charlestown** Tennessee | E-812 Chlorine Plant Shut	17. 7	08/22/88
etter from Tony E.	**Chatman** ERM-Southeast Inc. to Jim Kopotic EPA Regi	2. 2	04/25/89
8 provided by Olin	**Chemical** Company Charlestown Tennessee | E-812 Ch	17. 7	08/22/88
ice Davenport Olin	**Chemical** Company to Greer C. Tidwell EPA Region IV	10.11	01/10/89
Final Report Olin	**Chemical** Mercury Study November and December 1988	2. 2	04/07/89
L. Norsworthy Olin	**Chemical** to Greer C. Tidwell EPA Region IV | Lett	2. 4	03/02/89
E-812	**Chlorine** Plant Shutdown August 22 1988 provided by	17. 7	08/22/88
isease Registry to	**Chuck** Pietrosewicz Agency for Toxic Substances and	2. 8	05/04/89
for Monitoring and	**Cleaning** Homes ERM-Southeast Inc. | Protocol for	2. 4	03/02/89
	Cleaning of Certain Yeargin Employee's Homes ERM-S	2. 8	08/17/89
	Cleanup of Mercury contaminated homes begins March	13. 7	03/20/88
	Cleanup of Mercury Contamination of Thermometer Wo	17. 7	01/01/87
d by Olin Chemical	**Company** Charlestown Tennessee | E-812 Chlorine Pl	17. 7	08/22/88
port Olin Chemical	**Company** to Greer C. Tidwell EPA Region IV | Lette	10.11	01/10/89
Cleanup of Mercury	**contaminated** homes begins March 20 in Charleston T	13. 7	03/20/88
Cleanup of Mercury	**Contamination** of Thermometer Workers' Homes John Z	17. 7	01/01/87
Superfund and	**Contamination** of Workers' Homes J. Zirschky B. Gen	17. 7	11/01/87
o Phil Newman Olin	**Corporation** | Letter from Jim Kopotic EPA Region	2. 4	03/20/89

	DOCUMENT DESCRIPTION	BREAK	DATE
ton Tennessee Olin	**Corporation** Lower River Road Charleston Tennessee	10.11	12/16/88
y information Olin	**Corporation** TND003337292 Lower River Road Charlest	17. 7	01/01/85
Material Safety	**Data** Sheet Action Technologies Inc	17. 7	09/01/85
etter from Maurice	**Davenport** Olin Chemical Company to Greer C. Tidwel	10.11	01/10/89
um from William R.	**Davis** EPA Region IV to Jim Kopotic EPA Region IV |	17. 7	07/10/89
Study November and	**December** 1988 EPA Region IV | Final Report Olin C	2. 2	04/07/89
State of Tennessee	**Department** of Health and Environment | Letter fro	2. 8	01/17/89
e to the Tennessee	**Department** of Health and Environment Mercury Expos	2. 8	12/01/90
State of Tennessee	**Department** of Health and Environment to Barry L. J	2. 8	12/02/88
State of Tennessee	**Department** of Public Health | Report on Potential	17. 8	05/20/82
xic Substances and	**Disease** Registry | Letter from Patrick A. Turri S	2. 8	12/02/88
xic Substances and	**Disease** Registry | Memorandum from Kenneth G. Orl	2. 8	05/04/89
xic Substances and	**Disease** Registry | Final Report Technical Assista	2. 8	12/01/90
xic Substances and	**Disease** Registry to Chuck Pietrosewicz Agency for	2. 8	05/04/89
xic Substances and	**Disease** Registry to Patrick A. Turri State of Tenn	2. 8	01/17/89
al Hazardous Waste	**Disposal** Facility State of Tennessee Department of	17. 8	05/20/82
10 Respondent. EPA	**Docket** No. 88-34-C | Administrative Order In The	10.11	12/16/88
Memorandum from	**Doug** Lair EPA Region IV to Jim Kopotic EPA Region	2. 8	04/26/89
	E-812 Chlorine Plant Shutdown August 22 1988 provi	17. 7	08/22/88
Letter from Tony	**E.** Chatman ERM-Southeast Inc. to Jim Kopotic EPA R	2. 2	04/25/89
dum from Steven L.	**Edwards** OSHA to Michael Buczynski OSHA | Memorand	2. 2	12/05/88
Review of National	**Emission** Standards for Mercury EPA	17. 7	/ /
of Certain Yeargin	**Employee's** Homes ERM-Southeast Inc | Cleaning of	2. 8	08/17/89
ment of Health and	**Environment** | Letter from Mark A. Bashor Agency f	2. 8	01/17/89
ment of Health and	**Environment** Mercury Exposure Study Charleston Tenn	2. 8	12/01/90
ment of Health and	**Environment** to Barry L. Johnson Agency for Toxic S	2. 8	12/02/88
arleston Tennessee	**Environmental** News | Cleanup of Mercury contamina	13. 7	03/20/88
ndards for Mercury	**EPA** | Review of National Emission Standards for M	17. 7	/ /
37310 Respondent.	**EPA** Docket No. 88-34-C | Administrative Order In	10.11	12/16/88
Herbert Barden	**EPA** Region IV	2. 2	04/07/89
and December 1988	**EPA** Region IV | Final Report Olin Chemical Mercur	2. 2	04/07/89
nc. to Jim Kopotic	**EPA** Region IV | Letter from Tony E. Chatman ERM-S	2. 2	04/25/89
o Greer C. Tidwell	**EPA** Region IV | Letter from M. L. Norsworthy Olin	2. 4	03/02/89
dum from Doug Lair	**EPA** Region IV | Memorandum from Doug Lair EPA Reg	2. 8	04/26/89
o Greer C. Tidwell	**EPA** Region IV | Letter from Maurice Davenport Oli	10.11	01/10/89
m William R. Davis	**EPA** Region IV | Memorandum from William R. Davis	17. 7	07/10/89
	EPA Region IV Incident Notification Report	2. 1	10/24/88
Herbert Barden	**EPA** Region IV to Jim Kopotic EPA Region IV	2. 2	04/07/89
dum from Doug Lair	**EPA** Region IV to Jim Kopotic EPA Region IV | Memo	2. 8	04/26/89
m William R. Davis	**EPA** Region IV to Jim Kopotic EPA Region IV | Memo	17. 7	07/10/89
r from Jim Kopotic	**EPA** Region IV to Phil Newman Olin Corporation | L	2. 4	03/20/89
n Employee's Homes	**ERM-Southeast** Inc | Cleaning of Certain Yeargin E	2. 8	08/17/89
and Cleaning Homes	**ERM-Southeast** Inc. | Protocol for Monitoring and	2. 4	03/02/89
om Tony E. Chatman	**ERM-Southeast** Inc. to Jim Kopotic EPA Region IV |	2. 2	04/25/89
nvironment Mercury	**Exposure** Study Charleston Tennessee Agency for Tox	2. 8	12/01/90
	Facility information Olin Corporation TND003337292	17. 7	01/01/85
ous Waste Disposal	**Facility** State of Tennessee Department of Public H	17. 8	05/20/82
Mercury	**Fact** Sheet	17. 7	/ /
	Final Report Olin Chemical Mercury Study November	2. 2	04/07/89
	Final Report Technical Assistance to the Tennessee	2. 8	12/01/90
andum from Kenneth	**G.** Orloff and Bonnie S. Richter Agency for Toxic S	2. 8	05/04/89
mes J. Zirschky B.	**Gentry** and P. Marcus Journal of the American Indus	17. 7	11/01/87

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y Olin Chemical to	**Greer** C. Tidwell EPA Region IV | Letter from M. L	2. 4	03/02/89
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ssee Department of	**Health** and Environment | Letter from Mark A. Bash	2. 8	01/17/89
ssee Department of	**Health** and Environment Mercury Exposure Study Char	2. 8	12/01/90
ssee Department of	**Health** and Environment to Barry L. Johnson Agency	2. 8	12/02/88
ational Safety and	**Health** and Stanley A. Salsbury National Institute	2. 8	03/20/89
ational Safety and	**Health** to Wendy Kaye Agency | Memorandum from Ric	2. 8	03/20/89
	Herbert Barden EPA Region IV to Jim Kopotic EPA Re	2. 2	04/07/89
rcury contaminated	**homes** begins March 20 in Charleston Tennessee Envi	13. 7	03/20/88
Yeargin Employee's	**Homes** ERM-Southeast Inc | Cleaning of Certain Yea	2. 8	08/17/89
oring and Cleaning	**Homes** ERM-Southeast Inc. | Protocol for Monitorin	2. 4	03/02/89
nation of Workers'	**Homes** J. Zirschky B. Gentry and P. Marcus Journal	17. 7	11/01/87
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merican Industrial	**Hygiene** Association | Cleanup of Mercury Contamin	17. 7	01/01/87
merican Industrial	**Hygiene** Association | Superfund and Contamination	17. 7	11/01/87
omes ERM-Southeast	**Inc** | Cleaning of Certain Yeargin Employee's Home	2. 8	08/17/89
ction Technologies	**Inc** | Material Safety Data Sheet Action Technolog	17. 7	09/01/85
omes ERM-Southeast	**Inc.** | Protocol for Monitoring and Cleaning Homes	2. 4	03/02/89
tman ERM-Southeast	**Inc.** to Jim Kopotic EPA Region IV | Letter from T	2. 2	04/25/89
EPA Region IV	**Incident** Notification Report	2. 1	10/24/88
	Incident-Specific Regional Response Team Activatio	2. 8	11/18/88
al of the American	**Industrial** Hygiene Association | Cleanup of Mercu	17. 7	01/01/87
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Facility	**information** Olin Corporation TND003337292 Lower Ri	17. 7	01/01/85
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of Workers' Homes	**J.** Zirschky B. Gentry and P. Marcus Journal of the	17. 7	11/01/87
n EPA Region IV to	**Jim** Kopotic EPA Region IV | Herbert Barden EPA Re	2. 2	04/07/89
-Southeast Inc. to	**Jim** Kopotic EPA Region IV | Letter from Tony E. C	2. 2	04/25/89
r EPA Region IV to	**Jim** Kopotic EPA Region IV | Memorandum from Doug	2. 8	04/26/89
s EPA Region IV to	**Jim** Kopotic EPA Region IV | Memorandum from Willi	17. 7	07/10/89
Letter from	**Jim** Kopotic EPA Region IV to Phil Newman Olin Corp	2. 4	03/20/89
ter Workers' Homes	**John** Zirschky and Linden Witherell Journal of the	17. 7	01/01/87
onment to Barry L.	**Johnson** Agency for Toxic Substances and Disease Re	2. 8	12/02/88
d Linden Witherell	**Journal** of the American Industrial Hygiene Associa	17. 7	01/01/87
ntry and P. Marcus	**Journal** of the American Industrial Hygiene Associa	17. 7	11/01/87
nd Health to Wendy	**Kaye** Agency | Memorandum from Richard R.Hammel Na	2. 8	03/20/89
Memorandum from	**Kenneth** G. Orloff and Bonnie S. Richter Agency for	2. 8	05/04/89
A Region IV to Jim	**Kopotic** EPA Region IV | Herbert Barden EPA Region	2. 2	04/07/89
theast Inc. to Jim	**Kopotic** EPA Region IV | Letter from Tony E. Chatm	2. 2	04/25/89
A Region IV to Jim	**Kopotic** EPA Region IV | Memorandum from Doug Lair	2. 8	04/26/89
A Region IV to Jim	**Kopotic** EPA Region IV | Memorandum from William R	17. 7	07/10/89
Letter from Jim	**Kopotic** EPA Region IV to Phil Newman Olin Corporat	2. 4	03/20/89
randum from Steven	**L.** Edwards OSHA to Michael Buczynski OSHA | Memor	2. 2	12/05/88
vironment to Barry	**L.** Johnson Agency for Toxic Substances and Disease	2. 8	12/02/88
Letter from M.	**L.** Norsworthy Olin Chemical to Greer C. Tidwell EP	2. 4	03/02/89
morandum from Doug	**Lair** EPA Region IV to Jim Kopotic EPA Region IV	2. 8	04/26/89
	Letter from Jim Kopotic EPA Region IV to Phil Newm	2. 4	03/20/89
	Letter from M. L. Norsworthy Olin Chemical to Gree	2. 4	03/02/89
	Letter from Mark A. Bashor Agency for Toxic Substa	2. 8	01/17/89

	DOCUMENT DESCRIPTION	BREAK	DATE
	Letter from Maurice Davenport Olin Chemical Compan	10.11	01/10/89
	Letter from Patrick A. Turri State of Tennessee De	2. 8	12/02/88
	Letter from Tony E. Chatman ERM-Southeast Inc. to	2. 2	04/25/89
John Zirschky and	**Linden** Witherell Journal of the American Industria	17. 7	01/01/87
ation TND003337292	**Lower** River Road Charleston Tennessee 37310 ¦ Fac	17. 7	01/01/85
e Olin Corporation	**Lower** River Road Charleston Tennessee 37310 Respon	10.11	12/16/88
Letter from	**M.** L. Norsworthy Olin Chemical to Greer C. Tidwell	2. 4	03/02/89
nated homes begins	**March** 20 in Charleston Tennessee Environmental New	13. 7	03/20/88
y B. Gentry and P.	**Marcus** Journal of the American Industrial Hygiene	17. 7	11/01/87
Letter from	**Mark** A. Bashor Agency for Toxic Substances and Dis	2. 8	01/17/89
	Material Safety Data Sheet Action Technologies Inc	17. 7	09/01/85
ative Order In The	**Matter** Of Olin Mercury Spill Charleston Tennessee	10.11	12/16/88
Activation In the	**matter** of the Olin Yeargin Mercury Release ¦ Inci	2. 8	11/18/88
eam meeting in the	**matter** of the Olin Yeargin Mercury Release ¦ Minu	2. 8	11/18/88
Letter from	**Maurice** Davenport Olin Chemical Company to Greer C	10.11	01/10/89
onal Response Team	**meeting** in the matter of the Olin Yeargin Mercury	2. 8	11/18/88
	Memorandum from Doug Lair EPA Region IV to Jim Kop	2. 8	04/26/89
	Memorandum from Kenneth G. Orloff and Bonnie S. Ri	2. 8	05/04/89
	Memorandum from Richard R.Hammel National Institut	2. 8	03/20/89
	Memorandum from Steven L. Edwards OSHA to Michael	2. 2	12/05/88
	Memorandum from William R. Davis EPA Region IV to	17. 7	07/10/89
Cleanup of	**Mercury** contaminated homes begins March 20 in Char	13. 7	03/20/88
Cleanup of	**Mercury** Contamination of Thermometer Workers' Home	17. 7	01/01/87
sion Standards for	**Mercury** EPA ¦ Review of National Emission Standar	17. 7	/ /
th and Environment	**Mercury** Exposure Study Charleston Tennessee Agency	2. 8	12/01/90
	Mercury Fact Sheet	17. 7	/ /
f the Olin Yeargin	**Mercury** Release ¦ Incident-Specific Regional Resp	2. 8	11/18/88
f the Olin Yeargin	**Mercury** Release ¦ Minutes of the Regional Respons	2. 8	11/18/88
The Matter Of Olin	**Mercury** Spill Charleston Tennessee Olin Corporatio	10.11	12/16/88
port Olin Chemical	**Mercury** Study November and December 1988 EPA Regio	2. 2	04/07/89
L. Edwards OSHA to	**Michael** Buczynski OSHA ¦ Memorandum from Steven L	2. 2	12/05/88
	Minutes of the Regional Response Team meeting in t	2. 8	11/18/88
Protocol for	**Monitoring** and Cleaning Homes ERM-Southeast Inc.	2. 4	03/02/89
Review of	**National** Emission Standards for Mercury EPA	17. 7	/ /
m Richard R.Hammel	**National** Institute of Occupational Safety and Heal	2. 8	03/20/89
tanley A. Salsbury	**National** Institute of Occupational Safety and Heal	2. 8	03/20/89
Region IV to Phil	**Newman** Olin Corporation ¦ Letter from Jim Kopotic	2. 4	03/20/89
ssee Environmental	**News** ¦ Cleanup of Mercury contaminated homes begi	13. 7	03/20/88
ondent. EPA Docket	**No.** 88-34-C ¦ Administrative Order In The Matter	10.11	12/16/88
Letter from M. L.	**Norsworthy** Olin Chemical to Greer C. Tidwell EPA R	2. 4	03/02/89
Region IV Incident	**Notification** Report ¦ EPA Region IV Incident Noti	2. 1	10/24/88
ical Mercury Study	**November** and December 1988 EPA Region IV ¦ Final	2. 2	04/07/89
ional Institute of	**Occupational** Safety and Health and Stanley A. Sals	2. 8	03/20/89
ional Institute of	**Occupational** Safety and Health to Wendy Kaye Agenc	2. 8	03/20/89
2 1988 provided by	**Olin** Chemical Company Charlestown Tennessee ¦ E-8	17. 7	08/22/88
Maurice Davenport	**Olin** Chemical Company to Greer C. Tidwell EPA Regi	10.11	01/10/89
Final Report	**Olin** Chemical Mercury Study November and December	2. 2	04/07/89
m M. L. Norsworthy	**Olin** Chemical to Greer C. Tidwell EPA Region IV ¦	2. 4	03/02/89
IV to Phil Newman	**Olin** Corporation ¦ Letter from Jim Kopotic EPA Re	2. 4	03/20/89
arleston Tennessee	**Olin** Corporation Lower River Road Charleston Tenne	10.11	12/16/88
cility information	**Olin** Corporation TND003337292 Lower River Road Cha	17. 7	01/01/85
r In The Matter Of	**Olin** Mercury Spill Charleston Tennessee Olin Corpo	10.11	12/16/88

	DOCUMENT DESCRIPTION	BREAK	DATE
the matter of the	**Olin** Yeargin Mercury Release | Incident-Specific	2. 8	11/18/88
the matter of the	**Olin** Yeargin Mercury Release | Minutes of the Reg	2. 8	11/18/88
Administrative	**Order** In The Matter Of Olin Mercury Spill Charlest	10.11	12/16/88
um from Kenneth G.	**Orloff** and Bonnie S. Richter Agency for Toxic Subs	2. 8	05/04/89
Steven L. Edwards	**OSHA** | Memorandum from Steven L. Edwards OSHA to	2. 2	12/05/88
Steven L. Edwards	**OSHA** to Michael Buczynski OSHA | Memorandum from	2. 2	12/05/88
chky B. Gentry and	**P.** Marcus Journal of the American Industrial Hygie	17. 7	11/01/87
Letter from	**Patrick** A. Turri State of Tennessee Department of	2. 8	12/02/88
isease Registry to	**Patrick** A. Turri State of Tennessee Department of	2. 8	01/17/89
c EPA Region IV to	**Phil** Newman Olin Corporation | Letter from Jim Ko	2. 4	03/20/89
Registry to Chuck	**Pietrosewicz** Agency for Toxic Substances and Disea	2. 8	05/04/89
E-812 Chlorine	**Plant** Shutdown August 22 1988 provided by Olin Che	17. 7	08/22/88
Report on	**Potential** Hazardous Waste Disposal Facility State	17. 8	05/20/82
	Protocol for Monitoring and Cleaning Homes ERM-Sou	2. 4	03/02/89
own August 22 1988	**provided** by Olin Chemical Company Charlestown Tenn	17. 7	08/22/88
ssee Department of	**Public** Health | Report on Potential Hazardous Was	17. 8	05/20/82
andum from William	**R.** Davis EPA Region IV to Jim Kopotic EPA Region I	17. 7	07/10/89
andum from Richard	**R.Hammel** National Institute of Occupational Safety	2. 8	03/20/89
Incident-Specific	**Regional** Response Team Activation In the matter of	2. 8	11/18/88
Minutes of the	**Regional** Response Team meeting in the matter of th	2. 8	11/18/88
tances and Disease	**Registry** | Letter from Patrick A. Turri State of	2. 8	12/02/88
tances and Disease	**Registry** | Memorandum from Kenneth G. Orloff and	2. 8	05/04/89
tances and Disease	**Registry** | Final Report Technical Assistance to t	2. 8	12/01/90
ances and Disease	**Registry** to Chuck Pietrosewicz Agency for Toxic Su	2. 8	05/04/89
tances and Disease	**Registry** to Patrick A. Turri State of Tennessee De	2. 8	01/17/89
in Yeargin Mercury	**Release** | Incident-Specific Regional Response Tea	2. 8	11/18/88
in Yeargin Mercury	**Release** | Minutes of the Regional Response Team m	2. 8	11/18/88
ident Notification	**Report** | EPA Region IV Incident Notification Repo	2. 1	10/24/88
Final	**Report** Olin Chemical Mercury Study November and De	2. 2	04/07/89
	Report on Potential Hazardous Waste Disposal Facil	17. 8	05/20/82
Final	**Report** Technical Assistance to the Tennessee Depar	2. 8	12/01/90
on Tennessee 37310	**Respondent.** EPA Docket No. 88-34-C | Administrati	10.11	12/16/88
-Specific Regional	**Response** Team Activation In the matter of the Olin	2. 8	11/18/88
es of the Regional	**Response** Team meeting in the matter of the Olin Ye	2. 8	11/18/88
	Review of National Emission Standards for Mercury	17. 7	/ /
Memorandum from	**Richard** R.Hammel National Institute of Occupationa	2. 8	03/20/89
loff and Bonnie S.	**Richter** Agency for Toxic Substances and Disease Re	2. 8	05/04/89
TND003337292 Lower	**River** Road Charleston Tennessee 37310 | Facility	17. 7	01/01/85
Corporation Lower	**River** Road Charleston Tennessee 37310 Respondent.	10.11	12/16/88
337292 Lower River	**Road** Charleston Tennessee 37310 | Facility inform	17. 7	01/01/85
ration Lower River	**Road** Charleston Tennessee 37310 Respondent. EPA Do	10.11	12/16/88
Orloff and Bonnie	**S.** Richter Agency for Toxic Substances and Disease	2. 8	05/04/89
te of Occupational	**Safety** and Health and Stanley A. Salsbury National	2. 8	03/20/89
te of Occupational	**Safety** and Health to Wendy Kaye Agency | Memorand	2. 8	03/20/89
Material	**Safety** Data Sheet Action Technologies Inc	17. 7	09/01/85
lth and Stanley A.	**Salsbury** National Institute of Occupational Safety	2. 8	03/20/89
Mercury Fact	**Sheet**	17. 7	/ /
terial Safety Data	**Sheet** Action Technologies Inc	17. 7	09/01/85
812 Chlorine Plant	**Shutdown** August 22 1988 provided by Olin Chemical	17. 7	08/22/88
r Of Olin Mercury	**Spill** Charleston Tennessee Olin Corporation Lower	10.11	12/16/88
National Emission	**Standards** for Mercury EPA | Review of National Em	17. 7	/ /
ety and Health and	**Stanley** A. Salsbury National Institute of Occupati	2. 8	03/20/89

	DOCUMENT DESCRIPTION	BREAK	DATE
m Patrick A. Turri	**State** of Tennessee Department of Health and Enviro	2. 8	12/02/88
o Patrick A. Turri	**State** of Tennessee Department of Health and Enviro	2. 8	01/17/89
Disposal Facility	**State** of Tennessee Department of Public Health |	17. 8	05/20/82
Memorandum from	**Steven** L. Edwards OSHA to Michael Buczynski OSHA	2. 2	12/05/88
t Mercury Exposure	**Study** Charleston Tennessee Agency for Toxic Substa	2. 8	12/01/90
n Chemical Mercury	**Study** November and December 1988 EPA Region IV |	2. 2	04/07/89
n Agency for Toxic	**Substances** and Disease Registry | Letter from Pat	2. 8	12/02/88
r Agency for Toxic	**Substances** and Disease Registry | Memorandum from	2. 8	05/04/89
e Agency for Toxic	**Substances** and Disease Registry | Final Report Te	2. 8	12/01/90
r Agency for Toxic	**Substances** and Disease Registry to Chuck Pietrosew	2. 8	05/04/89
r Agency for Toxic	**Substances** and Disease Registry to Patrick A. Turr	2. 8	01/17/89
	Superfund and Contamination of Workers' Homes J. Z	17. 7	11/01/87
Regional Response	**Team** Activation In the matter of the Olin Yeargin	2. 8	11/18/88
Regional Response	**Team** meeting in the matter of the Olin Yeargin Mer	2. 8	11/18/88
Final Report	**Technical** Assistance to the Tennessee Department o	2. 8	12/01/90
Data Sheet Action	**Technologies** Inc | Material Safety Data Sheet Act	17. 7	09/01/85
ompany Charlestown	**Tennessee** | E-812 Chlorine Plant Shutdown August	17. 7	08/22/88
er Road Charleston	**Tennessee** 37310 | Facility information Olin Corpo	17. 7	01/01/85
er Road Charleston	**Tennessee** 37310 Respondent. EPA Docket No. 88-34-C	10.11	12/16/88
e Study Charleston	**Tennessee** Agency for Toxic Substances and Disease	2. 8	12/01/90
A. Turri State of	**Tennessee** Department of Health and Environment |	2. 8	01/17/89
Assistance to the	**Tennessee** Department of Health and Environment Mer	2. 8	12/01/90
A. Turri State of	**Tennessee** Department of Health and Environment to	2. 8	12/02/88
Facility State of	**Tennessee** Department of Public Health | Report on	17. 8	05/20/82
h 20 in Charleston	**Tennessee** Environmental News | Cleanup of Mercury	13. 7	03/20/88
y Spill Charleston	**Tennessee** Olin Corporation Lower River Road Charle	10.11	12/16/88
y Contamination of	**Thermometer** Workers' Homes John Zirschky and Linde	17. 7	01/01/87
emical to Greer C.	**Tidwell** EPA Region IV | Letter from M. L. Norswor	2. 4	03/02/89
ompany to Greer C.	**Tidwell** EPA Region IV | Letter from Maurice Daven	10.11	01/10/89
n Olin Corporation	**TND003337292** Lower River Road Charleston Tennessee	17. 7	01/01/85
Letter from	**Tony** E. Chatman ERM-Southeast Inc. to Jim Kopotic	2. 2	04/25/89
Johnson Agency for	**Toxic** Substances and Disease Registry | Letter fr	2. 8	12/02/88
Richter Agency for	**Toxic** Substances and Disease Registry | Memorandu	2. 8	05/04/89
nnessee Agency for	**Toxic** Substances and Disease Registry | Final Rep	2. 8	12/01/90
Richter Agency for	**Toxic** Substances and Disease Registry to Chuck Pie	2. 8	05/04/89
Bashor Agency for	**Toxic** Substances and Disease Registry to Patrick A	2. 8	01/17/89
er from Patrick A.	**Turri** State of Tennessee Department of Health and	2. 8	12/02/88
stry to Patrick A.	**Turri** State of Tennessee Department of Health and	2. 8	01/17/89
otential Hazardous	**Waste** Disposal Facility State of Tennessee Departm	17. 8	05/20/82
fety and Health to	**Wendy** Kaye Agency | Memorandum from Richard R.Ham	2. 8	03/20/89
Memorandum from	**William** R. Davis EPA Region IV to Jim Kopotic EPA	17. 7	07/10/89
irschky and Linden	**Witherell** Journal of the American Industrial Hygie	17. 7	01/01/87
d Contamination of	**Workers'** Homes J. Zirschky B. Gentry and P. Marcus	17. 7	11/01/87
ion of Thermometer	**Workers'** Homes John Zirschky and Linden Witherell	17. 7	01/01/87
leaning of Certain	**Yeargin** Employee's Homes ERM-Southeast Inc	2. 8	08/17/89
matter of the Olin	**Yeargin** Mercury Release | Incident-Specific Regio	2. 8	11/18/88
matter of the Olin	**Yeargin** Mercury Release | Minutes of the Regional	2. 8	11/18/88
orkers' Homes John	**Zirschky** and Linden Witherell Journal of the Ameri	17. 7	01/01/87
Workers' Homes J.	**Zirschky** B. Gentry and P. Marcus Journal of the Am	17. 7	11/01/87

Section III

CHRONOLOGICAL LISTING

ADMINISTRATIVE RECORD CHRONOLOGICAL LISTING

for the

OLIN CHEMICALS/GRP CHAS PLT Removal Site

/ /	17.7. "Review of National Emission Standards for Mercury," EPA (DATE UNKNOWN).
/ /	17.7. Mercury Fact Sheet (DATE UNKNOWN).
5/20/82	17.8. "Report on Potential Hazardous Waste Disposal Facility," State of Tennessee Department of Public Health (May 20, 1982).
1/ 1/85	17.7. Facility information, Olin Corporation - TND003337292, Lower River Road, Charleston, Tennessee 37310 (1985).
9/ 1/85	17.7. "Material Safety Data Sheet," Action Technologies, Inc (September 1985).
1/ 1/87	17.7. "Cleanup of Mercury Contamination of Thermometer Workers' Homes," John Zirschky and Linden Witherell, Journal of the American Industrial Hygiene Association (January 1987).
11/ 1/87	17.7. "Superfund and Contamination of Workers' Homes;" J. Zirschky, B. Gentry and P. Marcus; Journal of the American Industrial Hygiene Association (November 1987).
3/20/88	13.7. "Cleanup of Mercury contaminated homes begins March 20 in Charleston, Tennessee," Environmental News (March 20, 1988).
8/22/88	17.7. E-812 Chlorine Plant Shutdown August 22, 1988, provided by Olin Chemical Company, Charlestown, Tennessee (August 22, 1988). Objectives of Shutdown Olin Chemical Company, Charlestown, Tennessee.
10/24/88	2.1. EPA Region IV Incident Notification Report (October 24, 1988). This report concerns the August 22, 1988 Mercury release at the Olin Chemical Company, Charleston, Tennessee. Due to the CONFIDENTIAL nature of the material, portions of this report has been withheld.

11/18/88 2.8. Incident-Specific Regional Response Team Activation: In the matter of the Olin Yeargin Mercury Release (November 18, 1988). Including meeting agenda and site background information. Due to the CONFIDENTIAL nature of the material, portions of this report has been withheld.

11/18/88 2.8. Minutes of the Regional Response Team meeting in the matter of the Olin Yeargin Mercury Release (November 18, 1988).

12/ 2/88 2.8. Letter from Patrick A. Turri, State of Tennessee Department of Health and Environment, to Barry L. Johnson, Agency for Toxic Substances and Disease Registry (December 2, 1988). Request for EPA Region IV assistance in conducting a survey of the homes of exposed workers and evaluation of specimens.

12/ 5/88 2.2. Memorandum from Steven L. Edwards, OSHA, to Michael Buczynski, OSHA (December 5, 1988). A letter concerning Hopcalite Analytical Procedure for Mercury analysis.

12/16/88 10.11. Administrative Order, In The Matter Of: Olin Mercury Spill, Charleston, Tennessee, Olin Corporation, Lower River Road, Charleston, Tennessee 37310, Respondent. EPA Docket No.: 88-34-C (December 16, 1988).

1/10/89 10.11. Letter from Maurice Davenport, Olin Chemical Company, to Greer C. Tidwell, EPA Region IV (January 10, 1989). A letter acknowledging receipt of Administrative Order No. 88-34-C and state Olin Company's intent to comply, while denying that it is liable under Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601.

1/17/89 2.8. Letter from Mark A. Bashor, Agency for Toxic Substances and Disease Registry, to Patrick A. Turri, State of Tennessee Department of Health and Environment (January 17, 1989). Outlining the sampling and analysis work conducted by the Agency for Toxic Substances and Disease Registry as requested by the State of Tennessee Department of Health and Environment.

3/ 2/89 2.4. Letter from M. L. Norsworthy, Olin Chemical, to Greer C. Tidwell, EPA Region IV (March 2, 1989). A letter transmitting the "Protocol for Monitoring and Cleaning Homes," ERM-Southeast, Inc. and requesting attachments for the work plan.

3/ 2/89 2.4. "Protocol for Monitoring and Cleaning Homes," ERM-Southeast, Inc. (March 2, 1989).

3/20/89 2.4. Letter from Jim Kopotic, EPA Region IV, to Phil Newman, Olin Corporation (March 20, 1989). A letter concerning final work plan and transmitting attachments for the final work plan. Due to the CONFIDENTIAL nature of the material, portions of this report has been withheld.

3/20/89 2.8. Memorandum from Richard R.Hammel, National Institute of Occupational Safety and Health, and Stanley A. Salsbury, National Institute of Occupational Safety and Health, to Wendy Kaye, Agency for Toxic Substances and Disease Registry (March 20, 1989). A summary of the mercury release incident at Olin Chemical Company, Charlestown, Tennessee, and recommended changes to be instituted at the Olin facility.

4/ 7/89 2.2. Herbert Barden, EPA Region IV, to Jim Kopotic, EPA Region IV (April 7, 1989). A transmittal of the "Final Report: Olin Chemical Mercury Study, November and December 1988," EPA Region IV.

4/ 7/89 2.2. "Final Report: Olin Chemical Mercury Study, November and December 1988," EPA Region IV (April 7, 1989).

4/25/89 2.2. Letter from Tony E. Chatman, ERM-Southeast, Inc., to Jim Kopotic, EPA Region IV (April 25, 1989). A letter transmitting a summary of the dosimeter analysis for Mercury levels in the Yeargin employees homes, data attached. Due to the CONFIDENTIAL nature of the material, portions of this report has been withheld.

4/26/89 2.8. Memorandum from Doug Lair, EPA Region IV, to Jim Kopotic, EPA Region IV (April 26, 1989). Transmitting National Pollutant Discharge Elimination System, Resource Conservation and Recovery Act and Air Compliance inspection reports.

5/ 4/89 2.8. Memorandum from Kenneth G. Orloff and Bonnie S. Richter, Agency for Toxic Substances and Disease Registry, to Chuck Pietrosewicz, Agency for Toxic Substances and Disease Registry (May 4, 1989). A Memo concerning Mercury Contamination of indoor air in private residences, Charleston, Tennessee.

7/10/89 17.7. Memorandum from William R. Davis, EPA Region IV, to Jim Kopotic, EPA Region IV (July 10, 1989). Concerning TVA Fish Tissue Review relative to the Olin Chemical Company, Charlestown, Tennessee.

8/17/89 2.8. "Cleaning of Certain Yeargin Employee's Homes," ERM-Southeast, Inc (August 17, 1989). A report detailing the testing and cleaning of Yeargin workers homes following the Mercury Release at the Olin Chemical Company, Charlestown, Tennessee.

12/ 1/90 2.8. "Final Report: Technical Assistance to the Tennessee Department of Health and Environment, Mercury Exposure Study, Charleston, Tennessee," Agency for Toxic Substances and Disease Registry (December 1990).

Section IV

GUIDANCE DOCUMENTS

APPENDIX B

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

INDEX

TABLE OF CONTENTS

Category - Subcategory	Number Series*	Page
Pre-Remedial	0001-0002	1
Removal Action	1000-1008	1
RI/FS - General	2000-2012	2
RI/FS - RI Data Quality/Site & Waste Assessment	2100-2119	2
RI/FS - Land Disposal Facility Technology	2200-2212	4
RI/FS - Other Technologies	2300-2320	5
RI/FS - Ground-Water Monitoring & Protection	2400-2408	7
ARARs	3000-3005	8
Water Quality	4000-4003	9
Risk Assessment	5000-5015	9
Cost Analysis	6000-6001	11
Community Relations	7000-7000	11
Enforcement	8000-8001	12
Selection of Remedy/Decision Documents	9000-9001	12
Data Element Definitions		
List of Organizational Abbreviations and Acronyms Identified in the Index		

*The range for each number series identified represents the numbers assigned to those documents currently in the Compendium.

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

Doc No	Vol	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
0000	1	INDEX TO COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS	05/01/89	- OWPE - FRC-ENVIRONMENTAL MANAGEMENT, INC	Final	8		1) DATA ELEMENT DEFINITIONS 2) ORGANIZATIONAL ABBREVIATIONS AND ACRONYMS IDENTIFIED IN INDEX	
**		Pre-Remedial							
0001	1	EXPANDED SITE INSPECTION TRANSITIONAL GUIDANCE FOR FY-88	10/01/87	- OERR	Final	74	2		OSWER #9345.1-02
0002	1	PRELIMINARY ASSESSMENT GUIDANCE, FISCAL YEAR 1988	01/01/88	- OERR/HSCD	Final	83	2		OSWER #9345.0-01
**		Removal Action							
1000	1	CERCLA REMOVAL ACTIONS AT MINING RELEASE SITES	01/23/86	- LONGEST, H.L./OERR	Final	2	2		OSWER #9360.0-8
1001	1	COSTS OF REMEDIAL RESPONSE ACTIONS AT UNCONTROLLED HAZARDOUS WASTE SITES	01/01/81	- RISHEL, H.L., ET.AL./SCS ENGINEERS - ALBRECHT, O.W./MERL	Final	164	1		
1002	1	EMERGENCY RESPONSE PROCEDURES FOR CONTROL OF HAZARDOUS SUBSTANCE RELEASES	01/01/83	- MELVOLD, R.W./ROCKWELL INTERNATIONAL - MCCARTHY, L.T./MERL	Final	23	1		EPA-600/13-84-023
1003	1	ENVIRONMENTAL REVIEW REQUIREMENTS FOR REMOVAL ACTIONS	04/13/87	- OERR/ERD	Final	6	2		OSWER #9318.0-05
1004	1	GUIDANCE ON IMPLEMENTATION OF THE "CONTRIBUTE TO REMEDIAL PERFORMANCE" PROVISION	04/06/87	- OSWER	Final	6	2		OSWER #9360.0-13
1008	2	GUIDANCE ON NON-NPL REMOVAL ACTIONS INVOLVING NATIONALLY SIGNIFICANT OR PRECEDENT SETTING ISSUES	04/03/89	- LONGEST, H.L./OERR	Final	9	2	1) REQUEST FOR CONCURRENCE	OSWER #9360.0-19
1005	1	INFORMATION ON DRINKING WATER ACTION LEVELS	04/19/88	- FIELDS, JR., T./OSWER/ERD	Final	17	2	1) MEMO: RELEASES FROM LAWFULLY APPLIED PESTICIDES 2) MEMO DBCP CONTAMINATION 3) GUIDANCE FOR ETHYLENE DIBROMIDE IN DRINKING H2O	
1006	1	SUPERFUND REMOVAL PROCEDURES, REVISION #3	02/01/88	- OSWER/OERR	Final	365	1		OSWER #9360.0-03B
1007	1	THE ROLE OF EXPEDITED RESPONSE ACTIONS UNDER SARA	04/21/87	- LONGEST, H.L./OERR	Final	3	2		OSWER #9360.0-15
4002	26	INTERIM FINAL GUIDANCE ON REMOVAL ACTION LEVELS AT CONTAMINATED DRINKING WATER SITES [Secondary Reference]	10/06/87	- OSWER/OERR	Final	9	2		OSWER #9360.1-01
6001	32	REMOVAL COST MANAGEMENT MANUAL [Secondary Reference]	04/01/88	- OSWER/OERR	Final	170	1		OSWER #9360.0-02B

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

Doc NO	Vol	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
**		RI/FS - General							
2000	2	CASE STUDIES 1-23: REMEDIAL RESPONSE AT HAZARDOUS WASTE SITES	03/01/84	- CRD/OEET/MERL - OSWER/OERR	Final	830	1		EPA 540/2-84/002B
2001	3	EPA GUIDE FOR MINIMIZING THE ADVERSE ENVIRONMENTAL EFFECTS OF CLEANUP OF UNCONTROLLED HAZARDOUS-WASTE SITES	06/01/85	- ENVIRONMENTAL RESEARCH LABORATORY	Final	250	2		EPA/600/8-85/008
2002	3	GUIDANCE FOR CONDUCTING REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES UNDER CERCLA	10/01/88	- OSWER/OERR	Final	390	1		OSWER #9355.3-01
2003	3	JOINT CORPS/EPA GUIDANCE	06/24/83	- OERR/PAS	Final	42	2		OSWER #9295.2-02
2004	4	MODELING REMEDIAL ACTIONS AT UNCONTROLLED HAZARDOUS WASTE SITES (VOL. I-IV)	04/01/85	- BOLTWELL, S.H., ET.AL./ANDERSON-NICOLS AND CO - OSWER/OERR - AMMEN, D.C. AND BORNWELL, JR., T.O./MERL	Final	350	1		OSWER #9355.0-08
2005	4	POLICY ON FLOOD PLAINS AND WETLAND ASSESSMENTS FOR CERCLA ACTIONS	08/01/85	- FIDEMAN, JR., W.N./OERR - LUCERO, C./OWPE	Final	9	2		OSWER #9280.0-02
2006	4	REMEDIAL RESPONSE AT HAZARDOUS WASTE SITES: SUMMARY REPORT	03/01/84	- CRD/MERL	Final	95	1		EPA 540/2-84/002A
2007	4	REVISED PROCEDURES FOR IMPLEMENTING OFF-SITE RESPONSE ACTIONS	11/13/87	- PORTER, J.W./OSWER	Final	20	2		OSWER #9834.11
2008	4	RI/FS IMPROVEMENTS	07/23/87	- LONGEST, H.L./OERR	Final	11	2	1) RI/FS IMPROVEMENTS	OSWER #9355.0-20
2009	4	RI/FS IMPROVEMENTS FOLLOW-UP	04/25/88	- LONGEST, H.L./OERR	Final	16	2	1) RI/FS IMPROVEMENTS FOLLOW-UP 2) REMEDIAL INFORMATION TRANSFER ACTIVITIES	OSWER #9355.3-05
2010	4	SUPERFUND FEDERAL-LEAD REMEDIAL PROJECT MANAGEMENT HANDBOOK	12/01/86	- OERR	Draft	179	1		OSWER #9355.1-1
2011	5	SUPERFUND REMEDIAL DESIGN AND REMEDIAL ACTION GUIDANCE	06/01/86	- OERR	Final	100	1		OSWER #9355.0-4A
2012	5	SUPERFUND STATE-LEAD REMEDIAL PROJECT MANAGEMENT HANDBOOK	12/01/86	- OERR	Final	120	1		OSWER #9355.2-1
**		RI/FS - RI Data Quality/Site & Waste Assessment							
2100	5	A COMPENDIUM OF SUPERFUND FIELD OPERATIONS METHODS	12/01/87	- OERR - OWPE	Final	550	1		OSWER #9355.0-14
2101	6	DATA QUALITY OBJECTIVES FOR REMEDIAL RESPONSE ACTIVITIES: DEVELOPMENT PROCESS	03/01/87	- CDM FEDERAL PROGRAMS CORP - OERR/OWPE	Final	150	1		OSWER #9355.0-7B

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

Doc No	Vol	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
2102	6	DATA QUALITY OBJECTIVES FOR REMEDIAL RESPONSE ACTIVITIES: EXAMPLE SCENARIO: RI/FS ACTIVITIES AT A SITE W/ CONTAMINATED SOILS AND GROUNDWATER	03/01/87	- CDM FEDERAL PROGRAMS CORP - OERR/OWPE	Final	120	1		OSWER #9355.0-7B
2103	6	DESIGN AND DEVELOPMENT OF HAZARDOUS WASTE REACTIVITY TESTING PROTOCOL	02/01/84	- WOLBACH, C.D., ET. AL./ACUREX CORP. - BARKLEY, N./MERL	Final	150	1		EPA-600/2-84-057
2104	6	FIELD SCREENING FOR ORGANIC CONTAMINANTS IN SAMPLES FROM HAZARDOUS WASTE SITES	04/02/86	- ROFFMAN, H.K., ET. AL./NUS CORP. - CARTER, A./MICHIGAN DEPT. OF NATURAL RESOURCES - THOMAS, T./EPA	Final	11	2	1) MEMO: FIELD SCREENING FOR ORGANIC CONTAMINANTS	
2105	6	FIELD SCREENING METHODS CATALOG: USER'S GUIDE	09/01/88	- OERR/HSED	Final	90	1		EPA/540/2-88/005
2106	6	FIELD STANDARD OPERATING PROCEDURES MANUAL #4 SITE ENTRY	01/01/85	- OERR/ARSD	Final	29	2		OSWER #9285.2-01
2107	7	FIELD STANDARD OPERATING PROCEDURES MANUAL #6 WORK ZONES	04/01/85	- OERR/ARSD	Final	19	2		OSWER #9285.2-04
2108	7	FIELD STANDARD OPERATING PROCEDURES MANUAL #8 AIR SURVEILLANCE	01/01/85	- OERR/HSCD	Final	24	2		OSWER #9285.2-03
2109	7	FIELD STANDARD OPERATING PROCEDURES MANUAL #9 SITE SAFETY PLAN	04/01/85	- OERR/ARSD	Final	26	2	1) SAMPLE SITE SAFETY PLAN AND OSHA SAFETY PLAN 2) EMERGENCY OPERATION CODES REAL TIME MONITOR 3) RESPONSE SAFETY CHECK-OFF SHEET	OSWER #9285.2-05
2110	7	GEOPHYSICAL METHODS FOR LOCATING ABANDONED WELLS	07/01/84	- FRISCHKNECHT, L.M., ET. AL./U.S. GEOLOGICAL SURVEY - VANEE, J.J./EMSL	Final	211	1		EPA-600/4-84-065
2111	7	GEOPHYSICAL TECHNIQUES FOR SENSING BURIED WASTES AND WASTE MIGRATION	06/01/84	- BENSON, R.C., ET. AL./TECHNOS, INC. - VANEE, J.J./EMSL	Final	236	1		EPA-600/7-84/064
2112	8	GUIDELINES AND SPECIFICATIONS FOR PREPARING QUALITY ASSURANCE PROGRAM DOCUMENTATION	06/01/87	- ORD/QUALITY ASSURANCE MANAGEMENT STAFF	Final	31	2	1) MEMO: GUIDANCE ON PREPARING QAPPs DATED 6/10/87	
2113	8	LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING INORGANICS ANALYSES	07/01/88	- EPA DATA REVIEW WORK GROUP - BLEYLER, R./VIAR AND CO./SAMPLE MGMT OFFICE - HSED	Draft	20	2		
2114	8	LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING ORGANICS ANALYSES	02/01/88	- BLEYLER, R./VIAR AND CO./SAMPLE MGMT OFFICE - EPA DATA REVIEW WORKGROUP - HSED	Draft	45	2		

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

Doc No	Vol	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
2115	8	PRACTICAL GUIDE FOR GROUND-WATER SAMPLING	09/01/85	- BARCELONA, M.J., ET.AL./ILLINOIS ST. WATER SURVEY - SCALF, M.R./ORD/ERL	Final	175	1		EPA/600/2-85/104
2116	8	SEDIMENT SAMPLING QUALITY ASSURANCE USER'S GUIDE	07/01/85	- BARTH, D.S. & STARKS, T.S./UNIV. OF NEV, LAS VEGAS - BROWN, K.W./EARD	Final	120	1		EPA/600/4-85/048
2117	8	SOIL SAMPLING QUALITY ASSURANCE USER'S GUIDE	05/01/84	- BARTH, D.S. & MASON, B.J./U. OF NEVADA, LAS VEGAS - BROWN, K./ORD/EARD	Final	104	1		EPA 600/4-84/043
2118	9+	TEST METHODS FOR EVALUATING SOLID WASTE, LABORATORY MANUAL PHYSICAL/CHEMICAL METHODS, THIRD EDITION (VOLUMES IA, IB, IC, AND II)	11/01/86	- OSWER	Final	3000	1		
2119	11	USER'S GUIDE TO THE CONTRACT LABORATORY PROGRAM	12/01/88	- OERR/CLP SAMPLE MANAGEMENT OFFICE	Final	220	2		OSWER #9240.0-1
**		RI/FS - Land Disposal Facility Technology							
2200	12	COVERS FOR UNCONTROLLED HAZARDOUS WASTE SITES	09/01/85	- MCANENY, C.C., ET. AL./U.S. COE/WES - HOUTHOOFD, J.M./HWERL	Final	475	2		EPA/540/2-85/002
2201	13	DESIGN, CONSTRUCTION, AND EVALUATION OF CLAY LINERS FOR WASTE MANAGEMENT FACILITIES	11/01/88	- GOLDMAN, J.L., ET. AL./NUS - ROULIER, M.H./RREL	Final	500	2		EPA/530/SW-86/007F
2202	13	EVALUATING COVER SYSTEMS FOR SOLID AND HAZARDOUS WASTE	09/01/82	- LUTTON, R.J./U.S.A. COE/WES - LANDRETH, R.E./MERL	Final	58	2		OSWER #9476.00-1
2203	13	GUIDANCE MANUAL FOR MINIMIZING POLLUTION FROM WASTE DISPOSAL SITES	08/01/78	- TOLMAN, A.L., ET. AL./A.W. MARTIN ASSOCIATES, INC. - SANNING, D.E./MERL	Final	83	1		EPA-600/2-78-142
2204	13	LAND DISPOSAL RESTRICTIONS	08/11/87	- LONGEST, H.L./OERR - LUCERO, G./OWPE	Final	23	2	1) SUMMARY OF MAJOR LDR PROVISIONS AND CALIFORNIA LIST PROHIBITIONS 2) OTHER ATTACHS CITED ARE AVAILABLE IN	

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

DOC No	Vol	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
2205	14	LINING OF WASTE CONTAINMENT AND OTHER IMPOUNDMENT FACILITIES	09/01/88	- MATRECON, INC. - LANDRETH, R./ORD/RISK REDUCTION ENGINEERING LAB	Final	950	2	FED REG.	
2206	15	LINING OF WASTE IMPOUNDMENT AND DISPOSAL FACILITIES	03/01/83	- LANDRETH, R./MERL	Final	480	2		OSWER #9480.00-4
2207	15	PROCEDURES FOR MODELING FLOW THROUGH CLAY LINERS TO DETERMINE REQUIRED LINER THICKNESS	01/01/84	- OSW	Draft	145	2		OSWER #9480.00-9)
2208	15	RCRA GUIDANCE DOCUMENT: LANDFILL DESIGN LINER SYSTEMS AND FINAL COVER	07/01/82	- EPA	Draft	30	2		
2209	15	SETTLEMENT AND COVER SUBSIDENCE OF HAZARDOUS WASTE LANDFILLS: PROJECT SUMMARY	05/01/85	- MURPHY, W.L. - GILBERT, P.A.	Final	4	2		EPA-600/S2-85-035
2210	15	SUPPLEMENTARY GUIDANCE ON DETERMINING LINER/LEACHATE COLLECTION SYSTEM COMPATIBILITY	08/07/86	- WEDDLE, B.R./PERMITS AND STATE PROGRAMS DIV	Final	60	2	1) ANALYSIS AND LINERRINING OF UNEXPOSED & EXPOSED POLYMERIC MEMBRANE LINERS MATRECON, INC. 2) SEC. 3019 EXPOSURE INFO AND HEALTH ASSESSMENTS	OSWER #9480.00-13
2211	15	TECHNICAL GUIDANCE DOCUMENT: CONSTRUCTION QUALITY ASSURANCE FOR HAZARDOUS WASTE LAND DISPOSAL FACILITIES	10/01/86	- HERRMANN, J.G./AMERL/LAND POLLUTION CONTROL DIV - OSWER	Final	88	2		OSWER #9472.003
2212	15	TREATMENT OF REACTIVE WASTES AT HAZARDOUS WASTE LANDFILLS: PROJECT SUMMARY	01/01/84	- SHEDHER,D. ET AL./ARTHUR D. LITTLE, INC. - LANDRETH, R./MERL	Final	4	2		EPA/600/S2-83/118
3000	25	APPLICABILITY OF THE HSWA MINIMUM TECHNICAL REQUIREMENTS RESPECTING LINERS AND LEACHATE COLLECTION SYSTEMS (Secondary Reference)	04/01/85	- SKINNER, J./OSW	Final	3	2		OSWER #9480.01(85)

** RI/FS - Other Technologies

2300	16	A COMPENDIUM OF TECHNOLOGIES USED IN THE TREATMENT OF HAZARDOUS WASTES	09/01/87	- ORD/CERI	Final	49	2		EPA/625/8-87/014

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

DOC NO	VOL	TITLE	DATE	AUTHORS	STATUS	PAGES	TIER	ATTACHMENTS	OSWER/EPA NUMBER
2301	16	CARBON ADSORPTION ISOTHERMS FOR TOXIC ORGANICS	04/01/80	- DOBBS, R.A./MERL - COHEN, J.M./MERL	Final	321	2		EPA/600/8-80-023
2302	17	ENGINEERING HANDBOOK FOR HAZARDOUS WASTE INCINERATION	09/01/81	- BONNER, T.A., ET. AL./MONSANTO RESEARCH CORP. - OBERACKER, D.A./OFET	Final	445	2		OSWER #9488.00-5
2303	17	EPA GUIDE FOR IDENTIFYING CLEANUP ALTERNATIVES AT HAZARDOUS WASTE SITES AND SPILLS: BIOLOGICAL TREATMENT	-	- PACIFIC NORTHWEST LABORATORY - RANIERE, L.C./CORVALLIS ENVIRONMENTAL RESEARCH LAB	Final	120	2		EPA-600/3-83-063
2304	17	EPA GUIDE FOR INFECTIOUS WASTE MANAGEMENT	05/01/86	- OSWER/OSW	Final	75	2		OSWER #9410.00-2
2305	17	GUIDANCE DOCUMENT FOR CLEANUP OF SURFACE IMPOUNDMENT SITES	06/01/86	- CDM/WOODWARD-CLYDE/ROY F. WESTON - BARTH, E./OERR	Final	39	1		OSWER #9380.0-06
2306	17	GUIDANCE DOCUMENT FOR CLEANUP OF SURFACE TANK AND DRUM SITES	05/28/85	- CDM/WOODWARD-CLYDE/ROY F. WESTON/C.C. JOHNSON - BARTH, E. AND BIXLER, B./OERR	Final	135	1		OSWER #9380.0-03
2307	18	HANDBOOK FOR EVALUATING REMEDIAL ACTION TECHNOLOGY PLANS	08/01/83	- EHRENFELD, J. AND BASS, J./ARTHUR D. LITTLE INC. - PARKIN, H.R./MERL	Final	439	1		EPA-600/2-83-076
2308	18	HANDBOOK FOR STABILIZATION/SOLIDIFICATION OF HAZARDOUS WASTE	06/01/86	- CULLINANE JR., M.J. ET. AL./U.S. COE/WES - HOUTMOOFD, J.M./ORD/MERL	Final	125	1		EPA/540/2-86-001
2309	19	HANDBOOK REMEDIAL ACTION AT WASTE DISPOSAL SITES (REVISED)	10/01/85	- ORD/MERL - OSWER/OERR	Final	560	1		EPA/625/6-85/006
2310	20	LEACHATE PLUME MANAGEMENT	11/01/85	- REPO, E. AND KUFS, C./JRB ASSOCIATES - BARKLEY, N./EPA	Final	590	1		EPA/540/2-85/004
2311	20	MOBILE TREATMENT TECHNOLOGIES FOR SUPERFUND WASTES	09/01/86	- CAMP, DRESSER, AND MCKEE INC - GALER, L.D./HRSD	Final	130	1		EPA/540/2-86-001
2312	21	PRACTICAL GUIDE-TRIAL BURNS FOR HAZARDOUS WASTE INCINERATORS	04/01/86	- CORMAN, P., ET. AL./MIDWEST RESEARCH INSTITUTE - OBERACKER, D.A./MERL	Final	63	2		EPA/600/2-86/050
2313	21	PRACTICAL GUIDE-TRIAL BURNS FOR HAZARDOUS WASTE INCINERATORS. PROJECT SUMMARY	07/01/86	- CORMIN, P., ET.AL./MIDWEST RESEARCH INSTITUTE - OBERACKER, D.A./MERL	Final	2	1		EPA/600/S2-86/050

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

Doc No	Vol	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
2314	21	PROHIBITION ON THE PLACEMENT OF BULK LIQUID HAZARDOUS WASTE IN LANDFILLS-STATUTORY INTERPRETIVE GUIDANCE	06/11/86	- OSWER/OSW	Final	35	1	1) MEMO RE SAME SUBJECT FROM WILLIAMS, M.E./OSW	OSWER #9487 00-2A
2315	21	REVIEW OF IN-PLACE TREATMENT TECHNIQUES FOR CONTAMINATED SURFACE SOILS-VOL. 2: BACKGROUND INFORMAITON FOR IN-SITU TREATMENT	11/01/84	- SIMS, R.C., ET AL./JRB ASSOCIATES - BARKLEY, N./MERL	Final	350	1		EPA-540/2-84-003b
2316	21	REVIEW OF IN-PLACE TREATMENT TECHNIQUES FOR CONTAMINATED SURFACE SOILS-VOL. 1: TECHNICAL EVALUATION	09/19/84	- OSWER/OERR - ORD/MERL	Final	165	1		EPA/540/2-84-003a
2317	22	SLURRY TRENCH CONSTRUCTION FOR POLLUTION MIGRATION CONTROL	02/01/84	- OERR - ORD/MERL	Final	220	1		EPA/540/2-84-001
2318	22	SYSTEMS TO ACCELERATE IN SITU STABILIZATION OF WASTE DEPOSITS	09/01/86	- AMDURER, M., ET AL./ENVIROSPHERE CO. - GRUBE, W./HWERL	Final	285	1		EPA 540/2-86/002
2319	22	TECHNOLOGY SCREENING GUIDE FOR TREATMENT OF CERCLA SOILS AND SLUDGES	09/01/88	- OSWER/OERR	Final	130	1		EPA 540/2-88/004
2320	22	TREATMENT TECHNOLOGY BRIEFS: ALTERNATIVES TO HAZARDOUS WASTE LANDFILLS	07/01/86	- HWERL	Final	35	2		EPA/600/8-86/017
**		RI/FS - Ground-Water Monitoring & Protection							
2400	23	CRITERIA FOR IDENTIFYING AREAS OF VULNERABLE HYDROGEOLOGY UNDER RCRA: STATUTORY INTERPRETIVE GUIDANCE	07/01/86	- OSWER/OSW	Final	950	2		OSWER #9472 00-2A
2401	24	FINAL RCRA COMPREHENSIVE GROUND-WATER MONITORING EVALUATION (GME) GUIDANCE DOCUMENT	12/19/86	- LUCERO, G.A./OWPE	Final	55	2	1) RELATIONSHIP OF TECHNICAL INADEQUACIES TO GROUND-WATER PERFORMANCE STANDARDS	OSWER #9950 2
2402	24	GROUND-WATER MONITORING AT CLEAN-CLOSING SURFACE IMPOUNDMENT AND WASTE PILE UNITS	03/31/88	- PORTER, J.W./OSWER	Final	3	2		OSWER #9476 00-14
2403	24	GROUND-WATER PROTECTION STRATEGY	08/01/84	- OFFICE OF GROUND-WATER PROTECTION	Final	65	2		EPA/440/6-84-002
2404	24	GUIDELINES FOR GROUND-WATER CLASSIFICATION UNDER THE EPA GROUND-WATER PROTECTION STRATEGY	12/01/86	- OFFICE OF GROUND-WATER PROTECTION	Draft	600	2		
2405	24	OPERATION AND MAINTENANCE INSPECTION GUIDE (RCRA GROUND-WATER MONITORING SYSTEMS)	03/30/88	- OSWER/OWPE/RCRA ENFORCEMENT DIVISION	Final	50	2	1) TRANSMITTAL MEMO RE SAME SUBJECT	OSWER #9950-3

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

DOC NO	Vol	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
2406	24	PROTOCOL FOR GROUND-WATER EVALUATIONS	09/01/86	- HAZARDOUS WASTE GROUND WATER TASK FORCE	Final	200	2		OSWER #9080 0-1
2407	25	RCRA GROUND-WATER MONITORING TECHNICAL ENFORCEMENT GUIDANCE DOCUMENT(TEGD)	09/01/86	- EPA	Final	270	2		OSWER #9950.1
2408	25	RCRA GROUND-WATER MONITORING TECHNICAL ENFORCEMENT GUIDANCE DOCUMENT, TEGD: EXECUTIVE SUMMARY	07/01/87	- LUCERO, G.A./OMPE	Final	8	1		OSWER #9950.1-a
**		ARARS							
3000	25	APPLICABILITY OF THE RCRA MINIMUM TECHNICAL REQUIREMENTS RESPECTING LINERS AND LEACHATE COLLECTION SYSTEMS	04/01/85	- SKINNER, J./OSW	Final	3	2		OSWER #9480 01(85)
3001	25	CERCLA COMPLIANCE WITH OTHER ENVIRONMENTAL STATUTES	10/02/85	- PORTER, J.W./OSWER	Final	19	1	1) POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	OSWER #9234 0-2
3002	25	CERCLA COMPLIANCE WITH OTHER LAWS MANUAL	08/08/88	- OERR	Draft	245	2		OSWER #9234 1-01
3003	25	EPA'S IMPLEMENTATION OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986	05/21/87	- THOMAS, L. M./EPA	Final	4	2		
3004	25	GUIDANCE MANUAL ON THE RCRA REGULATION OF RECYCLED HAZARDOUS WASTES	03/01/86	- INDUSTRIAL ECONOMICS, INC. - OSW	Final	350	2		OSWER #9441 00-2
3005	25	INTERIM RCRA/CERCLA GUIDANCE ON NON-CONTIGUOUS SITES AND ON-SITE MANAGEMENT OF WASTE AND TREATMENT RESIDUE	03/27/86	- PORTER, J.W./OSWER	Final	8	2	1) COMBINING HAZARDOUS WASTE SITES FOR REM. ACTION	OSWER #9347 0-1
2400	23	CRITERIA FOR IDENTIFYING AREAS OF VULNERABLE HYDROGEOLOGY UNDER RCRA: STATUTORY INTERPRETIVE GUIDANCE [Secondary Reference]	07/01/86	- OSWER/OSW	Final	950	2		OSWER #9472 00-2A
2401	24	FINAL RCRA COMPREHENSIVE GROUND-WATER MONITORING EVALUATION (GME) GUIDANCE DOCUMENT [Secondary Reference]	12/19/86	- LUCERO, G.A./OMPE	Final	55	2	1) RELATIONSHIP OF TECHNICAL INADEQUACIES TO GROUND-WATER PERFORMANCE STANDARDS	OSWER #9950 2
2405	24	OPERATION AND MAINTENANCE INSPECTION GUIDE (RCRA GROUND-WATER MONITORING SYSTEMS) [Secondary Reference]	03/30/88	- OSWER/OWPE/RCRA ENFORCEMENT DIVISION	Final	50	2	1) TRANSMITTAL MEMO RE SAME SUBJECT	OSWER #9950-3
2407	25	RCRA GROUND-WATER MONITORING TECHNICAL ENFORCEMENT GUIDANCE DOCUMENT(TEGD) [Secondary Reference]	09/01/86	- EPA	Final	270	2		OSWER #9950 1
2408	25	RCRA GROUND-WATER MONITORING TECHNICAL ENFORCEMENT GUIDANCE DOCUMENT, TEGD: EXECUTIVE SUMMARY [Secondary Reference]	07/01/87	- LUCERO, G.A./OMPE	Final	8	1		OSWER #9950 1-a

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

Doc No	Vol	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
2208	15	RCRA GUIDANCE DOCUMENT: LANDFILL DESIGN LINER SYSTEMS AND FINAL COVER [Secondary Reference]	07/01/82	- EPA	Draft	30	2		
9001	32	RCRA/CERCLA DECISIONS MADE ON REMEDY SELECTION [Secondary Reference]	06/24/85	- KILPATRICK, M./COMPLIANCE BRANCH, OWPE	Final	3	2		
**		Water Quality							
4000	26	ALTERNATE CONCENTRATION LIMIT GUIDANCE PART 1, ACL POLICY AND INFORMATION REQUIREMENTS	07/01/87	- OSW/WMD	Final	124	2		OSWER #9481.00-6C
4001	26	GUIDANCE DOCUMENT FOR PROVIDING ALTERNATE WATER SUPPLIES	02/01/88	- OERR	Final	64	2		OSWER #9355.3-03
4002	26	INTERIM FINAL GUIDANCE ON REMOVAL ACTION LEVELS AT CONTAMINATED DRINKING WATER SITES	10/06/87	- OSWER/OERR	Final	9	2		OSWER #9360.1-01
4003	26	QUALITY CRITERIA FOR WATER 1986	05/01/87	- OFFICE OF WATER REGULATIONS AND STANDARDS	Final	325	2		EPA/440/5-86-001
2301	16	CARBON ADSORPTION ISOTHERMS FOR TOXIC ORGANICS [Secondary Reference]	04/01/80	- DOBBS, R.A./MERL - COHEN, J.M./MERL	Final	321	2		EPA/600/8-80-023
1005	1	INFORMATION ON DRINKING WATER ACTION LEVELS [Secondary Reference]	04/19/88	- FIELDS, JR., T./OSWER/ERD	Final	17	2	1) MEMO. RELEASES FROM LAWFULLY APPLIED PESTICIDES 2) MEMO DBCP CONTAMINATION 3) GUIDANCE FOR ETHYLENE DIBROMIDE IN DRINKING H2O	
**		Risk Assessment							
5000	27	ATSDR HEALTH ASSESSMENTS ON NPL SITES	06/16/86	- DEPT. OF HEALTH AND HUMAN SERVICES/ATSDR	Draft	14	2		
5001	27	CHEMICAL, PHYSICAL & BIOLOGICAL PROPERTIES OF COMPOUNDS PRESENT AT HAZARDOUS WASTE SITES	09/27/85	- CLEMENT ASSOCIATES, INC.	Final	320	2		OSWER #9850.3
5002	27	FINAL GUIDANCE FOR THE COORDINATION OF ATSDR HEALTH ASSESSMENT ACTIVITIES WITH THE SUPERFUND REMEDIAL PROCESS	05/14/87	- PORTER, J.W./OSWER/OERR - ATSDR	Final	22	2	1) SAME TITLE, DATED 4/22/87	OSWER #9285.4-01
5003	27	GUIDELINES FOR CARCINOGEN RISK ASSESSMENT (FEDERAL REGISTER, SEPTEMBER 24, 1986, p. 33992)	09/24/86	- EPA	Final	33	2		

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

Doc No	Vol	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
5004	27	GUIDELINES FOR EXPOSURE ASSESSMENT (FEDERAL REGISTER, SEPTEMBER 24, 1986, p. 34042)	09/24/86	- EPA	Final	14	2		
5005	27	GUIDELINES FOR HEALTH ASSESSMENT OF SUSPECT DEVELOPMENTAL TOXICANTS (FEDERAL REGISTER, SEPTEMBER 24, 1986, p. 34028)	09/24/86	- EPA	Final	14	2		
5006	27	GUIDELINES FOR MUTAGENICITY RISK ASSESSMENT (FEDERAL REGISTER, SEPTEMBER, 24, p 34006)	09/24/86	- EPA	Final	8	2		
5007	27	GUIDELINES FOR THE HEALTH RISK ASSESSMENT OF CHEMICAL MIXTURES (FEDERAL REGISTER, SEPTEMBER 24, 1986, p. 34014)	09/24/86	- EPA	Final	13	2		
5008	28+	HEALTH EFFECTS ASSESSMENT DOCUMENTS (58 CHEMICAL PROFILES) VOL 28: ACETONE, ARSENIC, ASBESTOS, BARIUM, BENZO(A)PYRENE, CADMIUM, CARBON TETRACHLORIDE, CHLOROBENZENE, CHLORDANE, CHLOROFORM, COAL TARS, COPPER, CRESOLS, CYANIDE, DDT, 1,1-DICHLOROETHANE, 1,2-DICHLOROETHANE; VOL 29: 1,1-DICHLOROETHYLENE, 1,2-DICHLOROETHYLENE, CIS-1,2-DICHLOROETHYLENE, ETHYLBENZENE, GLYCOL ETHERS, HEXACHLOROBENZENE, HEXACHLOROBUTADIENE, HEXACHLOROCYCLOPENTADIENE; HEXAVALENT CHROMIUM, IRON (AND COMPOUNDS), LEAD, LINDANE, MANGANESE (AND COMPOUNDS), MERCURY, METHYL ETHYL KETONE, METHYLENE CHLORIDE, NAPHTHALENE, NICKEL, PENTACHLOROPHENOL, PHENOL, PHENANTHRENE; VOL 30: POLYCHLORINATED BIPHENYLS (PCBS), POLYCYCLIC AROMATIC HYDROCARBONS (PAHS), PYRENE, SELENIUM (AND COMPOUNDS), SODIUM CYANIDE, SULFURIC ACID, 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN, 1,1,2,2-TETRACHLOROETHANE, TETRACHLOROETHYLENE, TOLUENE, 1,1,2-TRICHLOROETHANE, 1,1,1-TRICHLOROETHANE, TRICHLOROETHYLENE, 2,4,5-TRICHLOROPHENOL, 2,4,6-TRICHLOROPHENOL, TRIVALENT CHROMIUM, VINYL CHLORIDE, XYLENE, ZINC (AND COMPOUNDS)	09/01/84	- ORD/CHEA/ECAO - OSWER/OERR	Final	1750	2		EPA/540/1-86/001-058
5009	31	INTEGRATED RISK INFORMATION SYSTEM (IRIS) [A COMPUTER-BASED HEALTH RISK INFORMATION SYSTEM AVAILABLE THROUGH E-MAIL--BROCHURE ON ACCESS IS INCLUDED]	-	- OEA	Final	—	2		

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

Doc No	Vol.	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
5010	31	INTERIM POLICY FOR ASSESSING RISKS OF "DIOXINS" OTHER THAN 2,3,7,8-TCDD	01/07/87	- THOMAS, L.M./EPA	Final	50	2	1) INTERIM PROCEDURES FOR ESTIMATING RISKS ASSOCIATED WITH EXPOSURES TO MIXTURES: 10/86	
5011	31	PUBLIC HEALTH RISK EVALUATION DATABASE (PHRED) [USER'S MANUAL AND TWO DISKETTES CONTAINING THE DBASE III PLUS SYSTEM ARE INCLUDED]	09/16/88	- OERR/TOXICS INTEGRATION BRANCH	Final	~	2		
5012	31	ROLE OF ACUTE TOXICITY BIOASSAYS IN THE REMEDIAL ACTION PROCESS AT HAZARDOUS WASTE SITES	08/01/87	- ATHEY, L.A., ET AL./PACIFIC NORTHWEST LABORATORY - MILLER, W.E./CORVALLIS ENVIRONMENTAL RESEARCH LAB	Final	106	2		EPA/600/8-87/044
5013	31	SUPERFUND EXPOSURE ASSESSMENT MANUAL	04/01/88	- OERR	Final	160	1		OSWER #9285.5-1
5014	31	SUPERFUND PUBLIC HEALTH EVALUATION MANUAL	10/01/86	- OERR - OSWER	Final	500	1		OSWER #9285.4-1
5015	31	TOXICOLOGY HANDBOOK	08/01/85	- LIFE SYSTEMS, INC. - TYBURSKI, T.E./OMPE	Draft	126	2		OSWER #9850.2
8000	32	ENDANGERMENT ASSESSMENT GUIDANCE [Secondary Reference]	11/22/85	- PORTER, J.W./OSWER	Final	11	2		OSWER #9850.0-1
**		Cost Analysis							
6000	32	REMEDIAL ACTION COSTING PROCEDURES MANUAL	10/01/87	- JRB ASSOCIATES/CH2M HILL - ORD/MERL - OSWER/OERR	Final	56	1		
6001	32	REMOVAL COST MANAGEMENT MANUAL	04/01/88	- OSWER/OERR	Final	170	1		OSWER #9360.0-02B
1003	1	ENVIRONMENTAL REVIEW REQUIREMENTS FOR REMOVAL ACTIONS [Secondary Reference]	04/13/87	- OERR/ERD	Final	6	2		OSWER #9318.0-05
**		Community Relations							
7000	32	COMMUNITY RELATIONS IN SUPERFUND: A HANDBOOK (INTERIM VERSION)	06/01/88	- OERR	Final	188	2	1) CHAP. 6 OF THE COM REL HANDBOOK 11/03/88	OSWER #9230.0-03B

-INDEX-

COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

Doc No	Vol	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
**		Enforcement							
8000	32	ENDANGERMENT ASSESSMENT GUIDANCE	11/22/85	- PORTER, J.W./OSWER	Final	11	2		OSWER #9850.0-1
8001	32	INTERIM GUIDANCE ON POTENTIALLY RESPONSIBLE PARTY PARTICIPATION IN REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES	05/16/88	- PORTER, J.W./OSWER	Final	37	2		OSWER #9835.1a
**		Selection of Remedy/Decision Documents							
9000	32	INTERIM GUIDANCE ON SUPERFUND SELECTION OF REMEDY	12/24/86	- PORTER, J.W./OSWER	Final	10	2		OSWER #9355.0-19
9001	32	RCRA/CERCLA DECISIONS MADE ON REMEDY SELECTION	06/24/85	- KILPATRICK, M./COMPLIANCE BRANCH, OWPE	Final	3	2		

DATA ELEMENT DEFINITIONS

The data elements of the Compendium database, as identified on the index, are shown below:

DATA ELEMENT	DEFINITION
Doc No	Unique four-digit number assigned to a document included in the Compendium according to category.
Vol	Volume number of the binder in which the hard copy of the document is contained.
Title	Title of the document. **Secondary Reference** is identified following the title when a document relates to more than one category. The document itself is filed under the number series assigned to its primary category.
Date	The date the document was published by or released from the issuing office or entity.
Authors	Author(s) and affiliation(s). Also includes identification of the EPA Project Officer and issuing office, where applicable.
Status	Indicates the status of a document, either draft or final version.
Pages	Total number of printed pages of the document, including any attachments.
Tier	Tier 1 or Tier 2. Tier 1 documents are the core documents of the Compendium as listed in the pamphlet titled "Selected Technical Guidance for Superfund Projects," compiled by OERR. Tier 2 documents are all other documents included in the Compendium.
Attachments	Attachments to a document by complete or abbreviated title.
OSWER/EPA Number	EPA report or OSWER Directive System numbers, where applicable.

LIST OF ORGANIZATIONAL ABBREVIATIONS AND ACRONYMS IDENTIFIED IN THE INDEX

Organization	Acronym
Agency for Toxic Substances and Disease Registry	ATSDR
Center for Environmental Research Information	CERI
Contract Laboratory Program	CLP
U.S. Corps of Engineers	COE
Exposure Assessment Research Division	EARD
Environmental Criteria and Assessment Office	ECAO
Environmental Monitoring Systems Laboratory	EMSL
Emergency Response Division	ERD
Environmental Research Laboratory	ERL
Hazardous Response Support Division	HRSD
Hazardous Site Control Division	HSCD
Hazardous Site Evaluation Division	HSED
Hazardous Waste Engineering Research Laboratory	HWERL
Municipal Environmental Research Laboratory	MERL
Office of Environmental Engineering and Technology	OEET
Office of Emergency and Remedial Response	OERR
Office of Health Effects Assessment	OHEA
Office of Research and Development	ORD
Office of Solid Waste	OSW
Office of Solid Waste and Emergency Response	OSWER
Office of Waste Programs Enforcement	OWPE
Policy Analysis Staff	PAS
Waterways Experiment Station	WES
Waste Management Division	WMD

2 1 0001 Site: Break: 2.1 Other:

REGION IV INCIDENT NOTIFICATION REPORT

1. Case No.:

A. REPORTER

2. Reported: (mm/dd/yy) 10/24/88 | 3. Time: 1130 | Recorded By: Kopotic

4. Through NRC: | 5. NRC Case No.: | 33. Spill Date: 8/22/88 | 34. Spill Time:

6. Reported By: (b)(6) Personal Privacy

7. Organization Name: [redacted]

8. Organization: ☐ 9. discharger ☐ 10. public ☐ 11. state ☐ 12. local ☐ 13. federal

14. Address: (b)(6) Personal Privacy

15. City: [redacted] | 16. County: | 17. State (b)(6) Personal

18. Zip: [redacted] | 19. Phone: (b)(6) Personal Privacy

B. DISCHARGER

20. ☐ As Above in A if 9 applies | 21. Name: Olin Chemical Corp.

22. Address: Lower River Rd.

23. City: Charleston | 24. County: | 25. State Tn

26. Zip: 37310 | 27. Phone: (615) 336-4511

C. INCIDENT LOCATION

28. ☒ As Above in B | 29. Street or Approx. Location: 812 Cell Bldg. - Olin Plant

30. City: | 31. County: | 32. State

E. MATERIAL

Material: ☐ oil ☐ hazardous substance ☐ other	35. Material ☐ Unknown	UN/DOT No	CAS No.	CHRIS Code	Quantity Spilled	Amount Entered	Units (Circle 1)	>RQ
36. Mercury		37.	38.	39.	40.		41. lb. gal. bbl. oth	☐
42.		43.	44.	45.	46.		47. lb. gal. bbl. oth	☐
48.		49.	50.	51.	52.		53. lb. gal. bbl. oth	☐

F. SOURCE

Medium Affected: ☒ 63. air ☒ 64. land ☐ 65. water ☐ 66. groundwater ☐ 67. within facility only

68. Waterway Affected: | Tributary To:

Source of Spill: ☐ 54. highway ☐ 55. air transport ☐ 56. railway ☐ 57. vessel ☒ 58. fixed facility ☐ 59. pipeline ☐ 60. offshore | 61. Vehicle ID or Carrier No.:

62 & 76. Description:

H. CAUSE

Reported Cause: ☐ 69. transportation accident ☐ 70. equipment failure ☐ 71 operational error ☐ 72. natural phenomenon ☐ 73. dumping ☐ 74. unknown ☐ 75. other

I. DAM

Damages: 77. no. of injuries _____ 78. no of deaths _____ ☐ property damage > $50,000

J. ACTIONS

80. ☐ Evacuation | 81. Response Action Taken:

K. NOTIFIED

Caller Has Notified: ☐ 82. state/local ☐ 83. discharger ☐ 84. USCG ☐ 85. other ☐ 86. unknown

Agency Name

L. COMMENTS

87. Comments (b)(6) Personal Privacy was employed by Yeargin, Inc. who was contracted by Olin to replace pipes in facility. While working in 812 Cell Bldg. (b)(6) Personal Privacy was exposed to mercury as was the other crew members. (b)(6) Personal Privacy claimed there is 27 families that have been exposed to mercury from the job. (b)(6) Personal Privacy transported mercury from ☒ Additional Information

ADDITIONAL DATA FIELDS

Responding Agency: ☐ state ☐ local ☐ discharger ☐ federal ☐ EPA ☐ TAT ☐ unknown

Agency Name:

Responder (Contact):

EPA has notified: ☐ state ☐ local ☐ USCG ☐ RRT ☒ referral (see Section N)

ENFORCEMENT

CWA: 308 ☐ o ☐ c; 308c ☐ o ☐ c | CERCLA: 103c ☐; 104 ☐ | None: ☐

Referred to: NPDES ☐ TSCA ☐ WATER ☐ FEDFAC ☐ RCRA ☐ OTHER ATSDR

the plant to his residence. (b)(6) Personal [redacted] State Tn-OSHA conducted an investigation at his home and mercury vapor was detected [redacted] his carpet, floors, washer, truck, lunch box, etc. (b)(6) Personal [redacted] (b)(6) Personal Privacy [redacted] stated that when he got home from work that he found elemental mercury in his pants pockets. He is seeing Andrew Heath, MD, at the Region Middle Tn. Toxicology Center (615/343-6280) about his medical condition.

Note: Contact for Tn-OSHA that conducted investigation is

Norman Elkins - Chattanooga, Tn.
615/634-6408

SITE: OLIN CHEMICALS/GRP CHAS PLT

BREAK: 2.2

NOTE:

The Sampling and Analysis Data for the Olin Yeargin Mercury Release may be reviewed, by appointment only, at EPA Region IV, Atlanta, Georgia.

2 2 0001

Site: _____
Break: 2.2
Other: transmitted
12/5/88

U.S. DEPARTMENT OF LABOR
OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION
ANALYTICAL LABORATORY
390 WAKARA WAY
SALT LAKE CITY, UTAH 84108

FTS 583-5287 524-5287
Area Code: 801

DATE: June 14, 1978
PLY TO
TN OF: Steven L. Edwards

BJECT: Hopcalite Analytical Procedure

TO: Michael Buczynski
USDOL - OSHA
111 West Huron St.
Rm. 1002
Buffalo, N.Y. 14202

Enclosed is the analytical procedure used in the laboratory for the analysis of mercury on hopcalite. We use this procedure with the following modifications.

1) The test apparatus used is of the closed-loop flameless atomic absorption configuration.

2) A heating tape is used to prevent water vapor condensation in the absorption cell.

3) Aliquots of the sample to be analyzed and standards are prepared to 100 ml in 10% nitric acid.

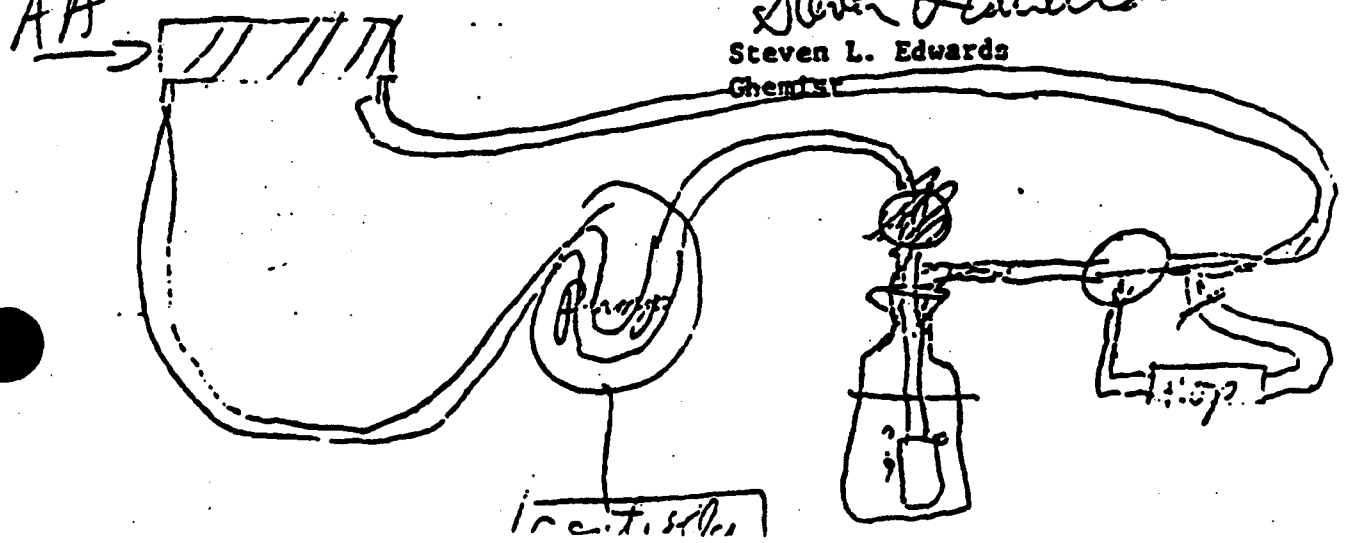
4) 10 ml of 10% stannous chloride solution (1:1 HCl) is used to reduce the mercury. (Note: The $SNCL_2$ solution is prepared fresh on the day it is to be used.)

If any questions arise, please feel free to contact me at the lab.

Thank you,

Steven L. Edwards

Steven L. Edwards
Chemist



RECEIVED
JUN - 8 1987

MERCURY IN HOPCALITE TUBES

Analyte: Mercury

Matrix: Collection on Hopcalite Tubes

Procedure: Digestion and Flameless Atomic Absorption

Date Issued: 9-15-82

Date Revised:

Method No.:

Range : .02 to 8 µg per hopcalite tube

Precision:

Classification:

1. Principle of the Method

Mercury vapor is collected on hopcolite tubes. The hopcalite is removed from the tube and ashed with nitric and hydrochloric acid in a 50 ml volumetric flask. The sample is diluted to volume with deionized water. An aliquot is transferred to a BOD bottle and diluted. The mercury is reduced to its elemental state with stannous chloride. The absorption signal is recorded and used to determine the concentration of mercury present-by flameless atomic absorption spectroscopy.

2. Range and Sensitivity

The range extends from 0.02 µg to 8 µg per hopcalite tube. The range can be extended beyond 8 µg by taking an aliquot of digested sample that is less than 25 ml.

3. Interferences

3.1 Metals such a gold, platinum, and copper will interfere since they form an alloy with the reduced mercury.

3.2 Organo-mercury is also collected in hopcalite tubes.

3.3 Certain organic solvents, such as benzene, that absorb 253.7 nanometer radiation would interfere if present in significant amounts as would any substance with broad absorption such as dust, water droplets, etc.

4. Precision and Accuracy

The precision and accuracy of the method have not been determined.

5. Advantages and Disadvantageous of the Method

5.1 A trained technician can do 20-40 samples a day.

5.2 Flameless atomic absorption is a more sensitive method than either spectometry, colorimetric, or tantalum boat methods.

5.3 This method is much more precise than the tantalum boat method.

5.4 Total mercury is measured. There is no distinction made between organic and inorganic mercury.

5.5 This method decomposes all organic mercury to inorganic mercury so it can be analyzed.

6. Apparatus

6.1 Sample Collection

Personal sampling pumps
Hopcalite tubes
Scorer for breaking the glass end seals

6.2 Sample Analysis (cold vapor)

6.2.1 Atomic Absorption Spectrophotometer: Atomic absorption spectrophotometer with a quartz window cell firmly in place on top of the burner head for air-acetylene flame, peristaltic pump, bubbler, strip charter recorder and accompanying polyethylene and glass tubing. Any atomic absorption unit having an open sample presentation area in which to mount the absorption cell is suitable. Instrument settings recommended by the particular manufacturer should be followed. Instruments designed specifically for the measurement of mercury using the cold vapor technique are commercially available and may be substituted for the atomic absorption spectrophotometer.

6.2.2 Hollow Cathode Lamp for Mercury

6.2.3 Chart Recorder: Any multi-range variable speed recorder that is compatible with the UV detection system is suitable.

6.2.4 Absorption Cell: Standard spectrophotometer cells 10 cm long, having quartz end windows may be used. Suitable cells may be constructed from plexiglass tubing, 1 inch

4 1/2 inches. The ends are ground perpendicular to the longitudinal axis and quartz windows (1 inch diameter by 1/16 inch thickness) are cemented in place. The cell is strapped to a burner for support and aligned in the light beam by use of two 2 inch by 2 inch cards. One inch diameter holes are cut in the middle of each card; the cards are then placed over each end of the cell. The cell is then positioned and adjusted vertically and horizontally to give the maximum transmittance.

6.2.5 Air Pump: Any peristaltic pump capable of delivering 1 liter of air per minute may be used.

6.2.6 Aeration Tubing: A straight glass frit having a coarse porosity. Glass and tygon tubing used for passage of the mercury vapor from the sample bottle to the absorption cell and return (see Figure 1.).

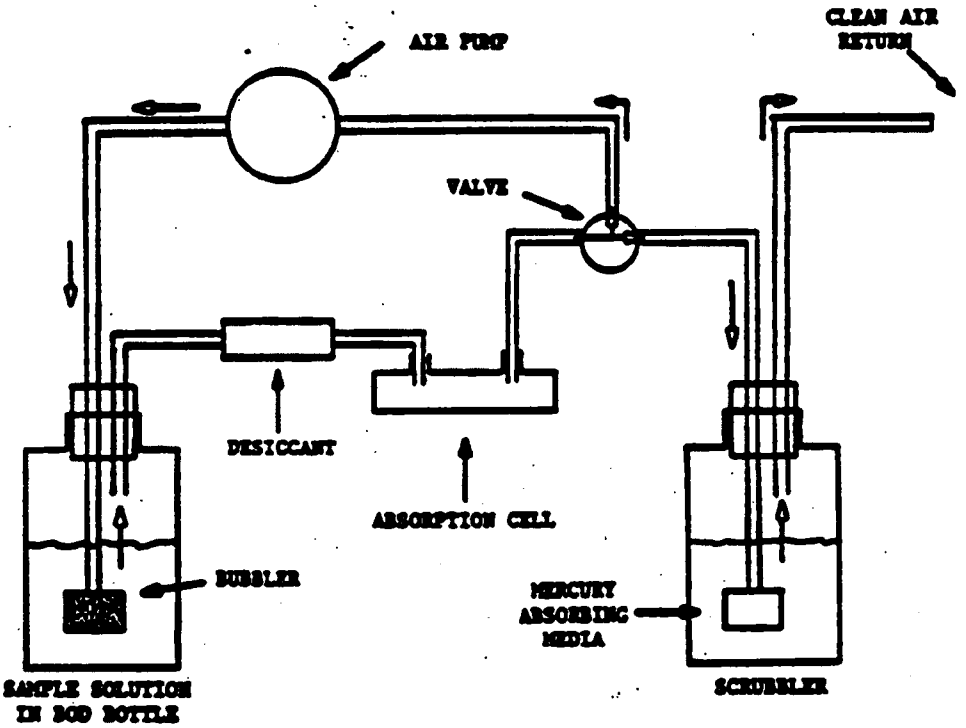


Figure 1. Apparatus for Flameless Mercury Determination

6.2.7 Drying Tube: 6 inch by 3/4 inch diameter tube containing 20 g of magnesium perchlorate. In place of the magnesium perchlorate drying tube, a small reading lamp with 60 watt bulb may be used to prevent condensation of moisture inside the cell. The lamp is positioned to shine on the absorption cell maintaining the air temperature in the cell about 10°C above ambient. A heating coil wrapped around the absorption cell controlled by a rheostat could also be used. The apparatus is assembled as shown in Figure 1.

6.3 Glassware (borosilicate)

6.3.1 Volumetric flasks as needed.

6.3.2 Volumetric pipettes as needed.

6.3.3 Micropipettes as needed.

6.3.4 300 ml BOD bottles.

6.3.5 Reagent dispensers.

7. Reagents

All reagents must be at least analytical reagent grade. Water must be doubly distilled or deionized.

7.1 Concentrated hydrochloric acid.

7.2 Concentrated nitric acid.

7.3 10% stannous chloride (1:1 HCl) is prepared by dissolving 8 g $SnCl_2$ (or 95 g $SnCl_2 \cdot 2H_2O$) in 400 ml concentrated hydrochloric acid in the hood followed by addition to 400 ml deionized water. Heat is evolved. This solution is slowly oxidized by oxygen in the air and should be prepared fresh the day it is used. An aliquot is useful in dispensing the reagent in the analysis.

7.4 10% Nitric Acid: Dilute 100 ml concentrated nitric acid to 1 liter with water.

7.5 Stock Standards: (prepare fresh daily)

100 µg/ml - 10 ml of 1000 µg/ml diluted to 100 ml with 10% HNO_3
10 µg/ml - 10 ml of 100 µg/ml diluted to 100 ml with 10% HNO_3

1 µg/ml - 10 ml of 10 µg/ml diluted to 100 ml with 10% HNO_3
0.1 µg/ml - 10 ml of 1 µg/ml diluted to 100 ml with 10% HNO_3
0.01 µg/ml - 10 ml of 0.1 µg/ml diluted to 100 ml with 10% HNO_3

7.6 Working Standards:

Working Standard	Stock Standard	
µg	µg/ml	ml/aliquot
0	0	0
0.1	0.1	1
0.2	0.1	2
0.5	0.1	5
.1	.1	1
.2	.1	2
.5	.1	5
1	1	1
2	1	2
4	1	4

The aliquot is placed in the BOD bottle along with enough water to make the total aliquot 100 ml. On the day of the analysis, prepare the standards and reagent blanks as indicated in 7.6. Two or three of each should be prepared. The 10% nitric acid used may be either measured out by graduated cylinder or by filling the BOD bottles to the mark. Stopper the bottles and swirl to mix. Set them away out of bright light.

8. Procedure

8.1 Cleaning of Equipment

8.1.1 Volumetric flasks, volumetric pipettes, and BOD bottles should be cleaned with hot 1:1 nitric acid and then rinsed at least three times with doubly distilled or deionized water.

8.1.2 The absorption cell must be cleaned out periodically. This is done by immersing in hot 1:1 nitric acid followed by numerous rinses with doubly distilled or deionized water and dried with acetone.

8.2 Collection and Shipping of Samples

8.2.1 Mercury vapor is collected in hopcalite tubes (a mixture of manganese and copper oxides) at an air flow rate of 1-3 liters per minute.

8.2.2 After sampling, the plastic end caps are replaced on the tubes.

8.2.3 The hopcalite tubes are packed separately from any other samples and are shipped to the laboratory for analysis.

8.3 Analysis of Samples

8.3.1 Hopcalite sample tubes are scored above the foam and broken. The foam is removed and discarded and the black granules of hopcalite are transferred into 50 ml volumetric flasks. A hooked piece of fine wire (32 gauge) makes a useful probe for removing the foam and coaxing out particles of hopcalite. In the hood, 2.5 ml nitric acid is added to the sample flask. This is followed by 2.5 ml hydrochloric acid. The solution will turn dark brown as the hopcalite slowly dissolves; swirl occasionally to speed the dissolution process. Dissolution should be complete prior to diluting the sample to volume. Dilute to volume with deionized water. The solution will be light blue or blue-green. This is a good place to stop if the analysis cannot be completed the same day.

8.3.2 Transfer 25 ml aliquots of each hopcalite sample solution to individual labeled BOD bottles and dilute to 100 ml with 10% nitric acid. 25 ml of sample solution remains for repetition.

8.3.3 When all samples and standards are in BOD bottles, the analysis is ready to begin.

8.3.4 Add 10 ml of stannous chloride solution. Place bubbler immediately into BOD bottle.

8.3.5 Record the maximum absorbance or measure peak heights and compare with standard solutions prepared in the same manner as the sample.

8.3.6 Set the instrument operating conditions as recommended by the manufacturer. The instrument should be set at the radiation intensity maximum for the analytical wavelength of 253.6 nm for mercury.

8.3.7 All the mercury vapor generated by this procedure must be scrubbed out in the scrubber or removed by direct exhaustion through the use of a good separate ventilation system. Charcoal tubes can also be used as a scrubber.

8.3.8 Standard solutions should match the sample matrix as closely as possible and should be run in duplicate at least. Standards should also be run between every four or five samples.

8.3.9 Blanks prepared in the same way as the standards and samples must be used each time samples are analyzed. At least two blanks are analyzed per batch of samples.

8.3.10 Should the absorbance go above 4 µg per BOD bottle, take a smaller aliquot of sample solution and go through the entire procedure again. To the extent possible, all determinations are to be based on replicate analyses.

9. Calibration and Standards

9.1 The standards solutions are bubbled through the absorbance cell and the absorbance or peak height is recorded. A calibration curve is prepared by plotting absorbance or peak height (units) versus micrograms of mercury. The best fit curve (calculated by linear least square regression analysis or some other method) is fitted to the data points. This line or the equation describing the line is used to obtain the number of micrograms of mercury in the sample aliquot (typically 25 ml).

10. Calculations

10.1 The net absorbances or peak heights for standards are reagent blank corrected.

10.2 Calculate the unblank corrected sample results as follows:

$$\mu g \text{ mercury/hopcalite tube} = \mu g \text{ mercury in aliquot} \times \frac{50 \text{ ml sample volume}}{\text{ml sample aliquot}}$$

11. References

11.1 NIOSH Manual of Analytical Methods, Second Edition, Volume 1, U.S. Department of Health, Education, and Welfare, Cincinnati, 1977.

11.2 Rathje, A.O.; and Marcero, D.H. (1976): Improved hopcalite procedure for the determination of mercury vapor in air by flameless atomic absorption. Am Ind Hyg Assoc J 37:331.

11.3 McCammon, C.S.; Edwards, S.L.; Hull, R.D.; and Woodfin, W.J. (1980): A comparison of four personal sampling methods for the determination of mercury vapors. Am Ind Hyg Assoc J 41:528.

11.4 Rathje, A.O. and Macero, D.H. (1975): Am Ind Hyg Assoc J May:311.

Table I

Anion	Useful Working Range µg/mL	Validation Range µg/mL	Sensitivity µg/mL/mm	LAQL* µg/mL	Precision % RSD	Recovery Efficiency %
Fluoride	0.4-20	0.5-10	0.01	0.4	11.6	97.2
Chloride	0.4-20	0.5-10	0.03	0.4	16.6	110.7
Nitrite	0.4-20	0.5-10	0.06	0.4	8.1	95.3
Phosphate	0.4-20	0.5-20	0.2	0.4	10.2	94.4
Nitrate	0.4-20	0.5-10	0.2	0.4	23.8	115.7
Sulfate	0.4-20	0.5-10	0.2	0.4	18.7	105.0

*Lowest analytically quantifiable level.

method of choice

2 2 0011.

Analysis of Mercury on Hopcalite Tubes

A. REAGENTS

1. Nitric Acid: Concentrated

2. Hydrochloric Acid: Concentrated and 6N. (Prepare by mixing 400 ml H_2O and 400 ml conc. HCl) ADD ACID TO WATER.

3. Stannous Chloride Solution: Add 100 gms $SnSO_4$ to 1 liter of 0.5N H_2SO_4. Mix before using as this solution is a suspension.

4. Sulfuric Acid, 0.5N: Carefully add 14 ml conc. H_2SO_4 to 900 ml deionized water and Q.S. to 1 liter.

B. ANALYSIS

1. Preparationof Standards (to be prepared-fresh each time). Take 1 ml of 1000 mg/l stock mercury solution and add to a 1 liter flask. Add 2 ml concentrated nitric acid. Dilute to 1 liter with deionized water. This prepares 1 ug/ml mercury.

2. To prepare standards:

   0.5 ml of working solution to 100 ml = 0.5 ug/sample

   1.0 ml of working solution to 100 ml = 1.0 ug/sample

   2.0 ml of working solution to 100 ml = 2.0 ug/sample

3. Preparation of Hopcalite tubes:

Pour the hopcalite granules into a 100 ml volumetric flask. Add 5 ml concentrated nitric acid followed by 5 ml concentrated hydrochloric acid. Warm the flask by placing it on a low temperature hot plate for a minute or two to aid in rapidly dissolving all the hopcalite granules. Cool and dilute to the mark with water.

Remove an aliquot of up to 50 ml, depending on the amount of mercury expected in the sample, and transfer to a bubbler flask containing sufficient water to bring the total volume to 100 ml. Add 5 ml of stannous chloride and immediately connect the bubbler flask to the test apparatus. Observe the peak height of the meter or recorder needle.

4. Run standards and samples on Coleman Mercury Analyzer.

5. Plot a curve of standards, ug mercury vs % T.

6. Read % T from graph to obtain ug mercury per 50 ml aliquot.

7. Calculations:

$$\text{ug Hg}/_{50\ \text{ml}} \times 2 = \text{ug Hg per tube}$$

$$\text{ug Hg per tube} \times \frac{1}{\text{liter of air taken}} \times 1000\ \text{l}/_{\text{m}^3} = \text{ug}/\text{m}^3$$

$$\text{ug Hg}/_{\text{m}^3} \div 1000 = \text{mg}/_{\text{m}^3}$$

8. Example calculation assuming 10 l air sample

1.3 ug/50 ml from curve

1.3 x 2 = 2.6 ug per tube

$$2.6\ \text{ug}/_{\text{tube}} \times \frac{1}{10\ \text{L}} \times 1000\ \text{L}/_{\text{m}^3} = 260\ \text{ug/m}^3$$

$$260\ \text{ug/m}^3 \div 1000 = 0.260\ \text{mg/m}^3\ \text{Hg}$$

2 2 0013

Site:
Break: 2.2
Other:

MEMORANDUM

DATE: April 7, 1989

SUBJECT: Final Report, Olin Mercury Results

FROM: Herbert Barden, Chief
Air Compliance Unit

THRU: Mike Carter, Chief M R Carter
Air & Water Compliance Section

TO: Jim Kopotic, OSC

We have enclosed two copies of the final report on results of the screening of the Yeargin Construction workers homes for mercury. If you have any questions please feel free to call.

2 2 0014

Site:
Break: 2.2
Other:

FINAL REPORT

OLIN CHEMICAL MERCURY STUDY

NOV. & DEC., 1988

U.S. EPA
REGION IV

ENVIRONMENTAL SERVICES DIVISION
COLLEGE STATION ROAD
ATHENS, GEORGIA

Olin Chemical Company, Charleston, TN
Mercury Screening
of Workers Homes

INTRODUCTION

At the request of Jim Kopotic, Region IV OSC, the Region IV Environmental Services Division screened six houses (located near the Olin Chemical Company plant in Charleston, Tennessee) for possible mercury contamination during November 2-4, 1988. The screening was prompted by reports that workers for the Yeargin Construction Company had been exposed to high levels of mercury contamination while working at the Olin Chemical Company on August 22, 1988. It was further reported that approximately 30 workers were undergoing treatment for mercury poisoning and there was some concern that the workers might have inadvertently carried some of the mercury home in contaminated clothing and tools.

The results of the initial screening of the six Yeargin workers homes showed all of the homes tested to have concentrations of mercury above the 0.5 ug/M3 that ATSDR recommended as the level of concern. Because of this, it was determined that the homes of all workers that could have been exposed to the high levels of mercury should be tested for mercury contamination. Jim Kopotic requested that ESD perform the testing of the homes of all other workers who could have been exposed to the mercury during the construction.

In response to this request, ESD performed testing for mercury in air at 39 homes of Yeargin workers during December 5-17, 1988. This made a total of 45 homes of Yeargin construction workers that were checked during November 2 - December 17, 1988.

BACKGROUND

On August 12, 1988, employees of the Yeargin Construction Company were reportedly exposed to extremely high levels of mercury while repairing header pipes in a chlor-alkali cell building at the Olin Chemical Company in Charleston, Tennessee. Approximately thirty of the construction workers that were exposed have been diagnosed as having mercury poisoning. Many of these workers are currently undergoing chelation therapy at the Vanderbilt Medical Center. Since the worker exposure was reportedly very intense and the workers did not remove contaminated clothing or cleanup prior to leaving the Olin site, the Region IV Emergency Response and Control Section requested that the Environmental Services Division screen for mercury in several residences of the construction workers to determine if their families were being exposed to hazardous

concentrations of mercury.

This initial screening was performed on six of the homes that were chosen at random. The concentrations in the air in the breathing zone of the six houses tested ranged from 1.0 ug/M3 to 5.0 ug/M3. At the Regional Response Team meeting that followed on November 18, 1988, ATSDR recommended an action level of 0.5 ug/M3 as a "safe" level and requested ESD to monitor all homes of Yeargin workers present during the August 22 repair incident at the Olin facility for possible mercury contamination.

OBJECTIVE

The objective of this study was to determine if there were hazardous concentrations of mercury in the air in the residences of the construction workers that were working at the Olin plant on August 22, 1988 when the exposure occurred. In addition, if elevated concentrations of mercury were found an effort was made to pinpoint the areas of highest concentration.

STUDY AREA

The residences of the Yeargin Construction workers are scattered in several mountainous counties surrounding the Olin facility.

SAMPLING PLAN

A 12-hour sample was taken at each house using a Jerome dosimeter tube and an Alpha battery powered sampling pump. In addition to the 12-hour samples taken with the dosimeter tubes, several instantaneous readings were taken utilizing Jerome model 411 portable Hg analyzers. The purpose of using the dosimeter tubes was to sample relatively large volumes of air in order to collect enough mercury to lower the detection limits of the method to well below the 0.5 ug/M3 recommended ATSDR action level. Approximately 36 liters of air was drawn through the dosimeter tubes during each 12-hour sampling period to lower the detection limit to 0.1 ug/M3.

The instantaneous readings from the Jerome model 411 portable Hg analyzer were used to detect areas of high mercury concentrations in the homes.

ANALYTICAL PLAN & QUALITY ASSURANCE

All dosimeter tubes were analyzed in a mobile laboratory that was transported to the Athens, Tennessee area and equipped for their analysis. All dosimeter tubes were analyzed in this mobile laboratory using a Jerome model 511 Hg analyzer. The analyzer was

calibrated each day before operation and the zero checked between each sample.

For each sampling day, one house was picked at random and a duplicate set of dosimeter samplers was operated to help define the precision of the method. In addition, a small number of homes of people not associated with Olin Chemical or Yeargin were sampled to help determine the background level of mercury in the Charleston, Tennessee area. Further, with each days batch of dosimeter tubes, one tube was cleaned and transported but not exposed to serve as a trip blank to assure that there was no passive contamination of the dosimeter tubes. The trip blanks results, shown in table 3, were all below the minimum detectable limit.

RESULTS

The results of the dosimeter tubes (both the initial November sampling and the December sampling) are shown in Figure 1 below and Table 1. The dosimeter results from the Yeargin workers homes, show 25 homes above the 0.5 ug/M3 limit and 20 homes below the 0.5 ug/M3 limit.

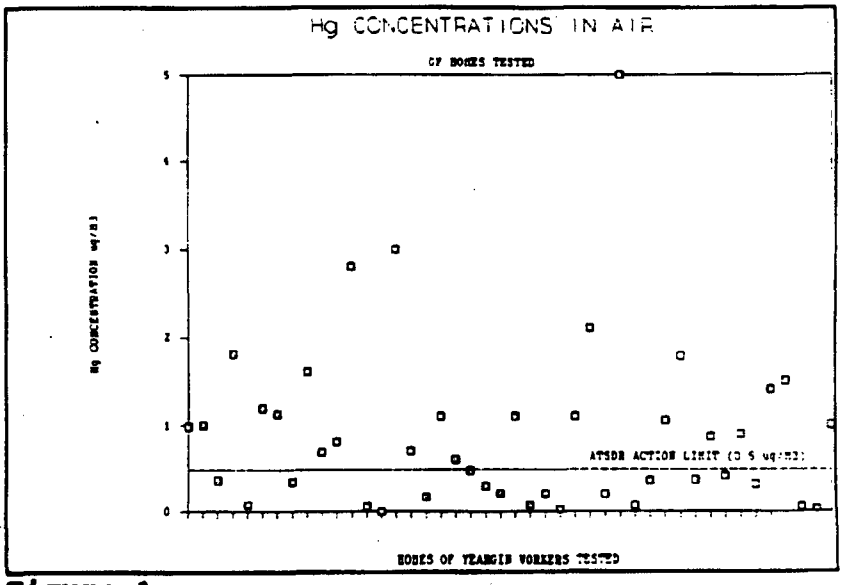


Figure 1

The three highest instantaneous readings for each home are shown in Table 2. They range from a high of 141 ug/M3 (inside a plastic bag containing clothes that were worn during the construction) to readings of 0. It should be noted, that an accurate multi-point calibration of the Jerome 411 was not possible. Therefore, all **instantaneous readings** should **only** be used as **rough indicators** of where high concentrations of mercury were found and not taken as accurate quantitation of the mercury concentrations in the homes. They did show typical areas of contamination including vacuum cleaners, washing machines, work boots, floor boards of work vehicles, and couches and chairs used by the workers, etc.

The results from the duplicate dosimeters are shown in Table 4. They indicate that an average precision of +/- 5% was obtained for

the dosimeter tubes. The results from the dosimeter tubes placed in series are shown in Table 6. They indicate that the dosimeter tubes had an average collection efficiency of 95%.

Two additional houses (other than the ones shown in Tables 1 & 2) were sampled as background houses but could not be used because it was determined after the sampling that the homeowners had ties to either Olin or Yeargin. In the first case, the homeowner was a part-time Olin employee. In the second case, the homeowner was a relative of a Yeargin employee who often visited after work (before going home). The results from these houses are listed in Table 5. They do point out the possibility that concentrations of mercury above the 0.5 ug/M3 may not be uncommon for homes of workers at the Olin chlor-alkali facility, even if they were not exposed to the concentrations similar to the ones at the plant on August 22, 1988.

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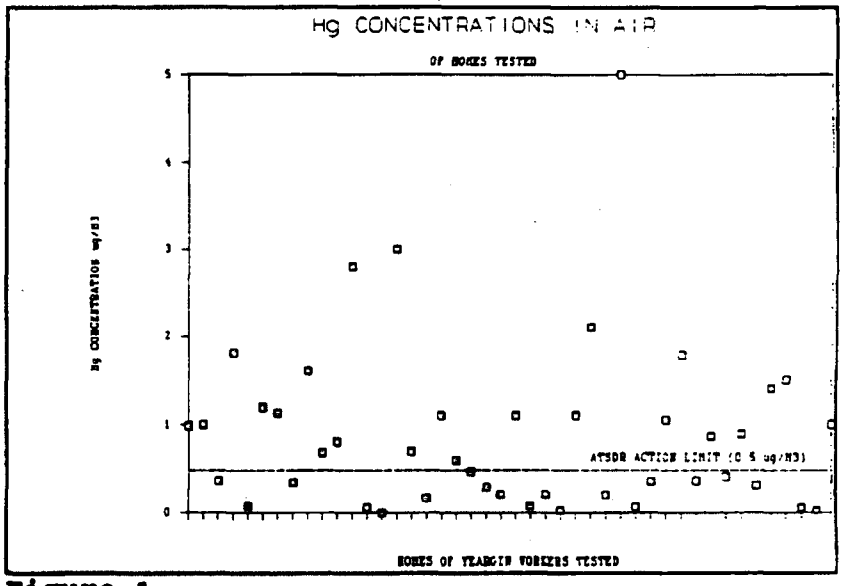

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MERCURY STUDY
DOSIMETER TUBE READINGS
Olin Chemical Company Study

Monitoring of worker's (who may have been exposed to mercury on August 22, 1988 at the Olin Chemical Company)

#	WORKER	SAMPLE DATE (date started)	Hg conc ug/M3	
B1 Background	No. 1	12/10/88	< (0.10)U	homes in Athens, TN area of persons not associated with Olin or Yeargin Construction
B3 Background	No. 3	12/11/88	< (0.10)U	
B4 Background	No. 4	12/11/88	< (0.10)U	
B6 Background	No. 6	12/13/88	< (0.10)U	
		AVG=	< (0.10)U	

BACKGROUND HOMES IN ATHENS, GA

B10 Background	Athens, Ga	11/20/88	0.31	(chemist who performs Hg analysis)
B11 Background	Athens, Ga	11/21/88	< (0.10)U	
B12 Background	Athens, Ga	11/23/88	0.22	(chemist who's son has broken thermometer in room)
B13 Background	Athens, Ga	11/23/88	0.11	
B14 Background	Athens, Ga	11/23/88	0.39	(nurse with Hg manometer type blood pressure meter in house)
B15 Background	Athens, Ga	11/23/88	0.45	(apartment of Environmental Scientist who samples at Hg sites)
		GA background AVG=	0.26	

U = Hg was **NOT** DETECTED. The value shown in the parenthesis is the minimum quanitation limit.

TABLE 1

HOMES ABOVE 0.5 ug/M3

#	SAMPLE DATE (date started)	Hg conc ug/M3
37	11/02/88	5.0
* 15	12/06/88	> 3.0
19	12/10/88	> 3.0
51	11/03/88	2.4
35	11/03/88	2.1
42	12/06/88	2.1
44	12/07/88	2.0
4	12/05/88	1.8
9	11/02/88	1.6
49	12/12/88	1.4
7	12/10/88	1.2
**23	12/07/88	1.1
28	12/06/88	1.1
34	11/03/88	1.1
41	12/08/88	1.1
***2	11/03/88	1.0
53	12/08/88	1.0
1	12/07/88	0.99
47	12/08/88	0.90
14	12/08/88	0.81
20	12/08/88	0.71
11	12/09/88	0.69
24	12/07/88	0.61
38	12/12/88	0.57
32	12/13/88	0.53

HOMES ABOVE 0.5 ug/M3 = 25

* First dosimeter desorption off scale. Actual value is at least stated value.

** Workers #23 and #22 share the same residence.

*** Workers #2 and #16 share the same residence.

TABLE 1

HOMES BELOW 0.5 ug/M3

#	SAMPLE DATE (date started)	Hg conc ug/M3
25	12/10/88	0.48
46	12/11/88	0.43
3	12/08/88	0.38
43	12/05/88	0.38
40	12/05/88	0.37
8	12/07/88	0.36
5	12/09/88	0.35
48	12/08/88	0.33
26	12/09/88	0.30
27	12/12/88	0.22
36	12/09/88	0.21
21	12/09/88	0.17
6	12/08/88	< (0.10)U
31	12/08/88	< (0.10)U
39	12/08/88	< (0.10)U
17	12/05/88	< (0.10)U
50	12/11/88	< (0.10)U
33	12/09/88	< (0.10)U
52	12/05/88	< (0.10)U
18	12/05/88	< (0.10)U

HOMES BELOW 0.5 ug/M3 Hg= 20

U = Hg was NOT DETECTED. The value shown in the parenthesis is the minimum quanitation limit.

TABLE 2

MERCURY STUDY
Jerome Model 411 Mercury Analyzer
HIGHEST 3 INSTANTEOUS READINGS IN WORKER'S HOMES

#	SAMPLE DATE (date started)	READING 1 ug/M3	LOCATION 1	READING 2 ug/M3	LOCATION 2	READING 3 ug/M3	LOCATION 3
B1	12/10/88	0	Living Room	0	Washer/Dryer	0	Bedroom
B3	12/11/88	0	Living Room	0	Master Bedroom	0	Den
B4	12/11/88	0	Living Room	0	Kitchen		
B6	12/13/88	0	Den	0	Kitchen	0	Living Room
B10	11/20/88	0	Living Room	0	Kitchen	0	Bedroom
B11	11/21/88	0		0		0	
B12	11/23/88	0		0		0	
B13	11/23/88	0		0		0	
B14	11/23/88	0		0		0	
B15	11/23/88	0		0		0	
1	12/07/88	6	bottom of tub	1	washing machine	0	living room
2 *	11/03/88	6	kitchen counter	5	living room chair	5	bedroom
3	12/08/88	5	over couch	3	living room	3	bedroom
4	12/05/88	0	living room	0	bedroom	0	child's bedroom
5	12/09/88	50	Work boots	3	Jeep floorboard	2	carpet front door
6	12/08/88	0	den	0	master bath	0	childs room
7	12/10/88	3	Washer	1	boots	1	truck floorboard
8	12/07/88	0	living room	0	laundry room	0	kitchen
9	11/02/88	20	work boots	10	work truck	3	washing machine
11	12/09/88	0	living room	0	kitchen	0	master bedroom
[illegible]	12/08/88	16	work boots	12	inside vacuum	11	bathroom
[illegible]	12/06/88	40	washing machine	27	work boots	24	living room carpet
[illegible]	12/05/88	0	living room	0	back porch	0	bathroom
18 **	12/05/88	141	work boots -in bag	90	work clothes -in bag	6	Toyota floorboard
19	12/10/88	15	Dining Room	13	Wash Area Front Yard	12	Bedroom over bed
20	12/08/88	8	Closet area	5	bathroom tub drain	2	master bathroom
21	12/09/88	0	living room	0	washing machine	0	bathroom
23 ***	12/07/88	0	living room	0	kitchen	0	bedroom
24	12/07/88	0	living room	0	master bedroom	0	kitchen
25	12/10/88	18	Den Area	5	Utility Room washer	4	bottom of washer
26	12/09/88	2	work boots	0	living room	0	bathroom
27	12/13/88	0	Living Room	0	Washer/Dryer	0	Pinto(work car)
28	12/06/88	10	floorboard	5	clothes hamper	4	bedroom
31	12/08/88	7	vacuum cleaner	6	kitchen	5	laundry room
32	12/05/88	8	vacuum cleaner	8	bathroom carpet	4	work boots
33	12/09/88	0	living room	0	vacuum cleaner	0	kitchen
34	11/03/88	54	washing machine	6	bedroom	2	living room
35	11/03/88	19	washing machine	4	work truck	2	master bathroom
36	12/09/88	10	vacuum cleaner	7	work boots	6	clothes hamper
37	11/02/88	12	tool bucket	11	washing machine tub	8	Ford Bronco
38	12/12/88	38	Vacuum Nozzle	25	Vacuum Bag	9	Basement Den
39	12/08/88	0	living room	0	master bedroom	0	kitchen
40	12/05/88	13	washing machine	5	kitchen	2	bedroom
41	12/08/88	92	vacuum cleaner	18	work boots	15	work cap
42	12/06/88	7	work boots	6	shower drain	6	living room couch
43	12/05/88	0	kitchen	0	living room	0	children's room
44	12/07/88	33	vacuum cleaner	10	guest bedroom	8	washing machine
46	12/11/88	0	Living Room	0	Vacuum Cleaner	0	Shower Drain
47	12/08/88	4	vacuum cleaner	3	washing machine	3	bathroom tub
48	12/08/88	0	living room	0	washing machine	0	kitchen
49	12/12/88	24	Vacuum Inlet	13	Carpet by couch	13	Childs bedroom
50	12/11/88	82	Vacuum Cleaner	3	Couch living r.	2	Bedroom center
5[illegible]	12/05/88	0	living room	0	laundry room	0	kitchen
[illegible]	12/08/88	9	kitchen sink drain	9	foyer	8	on grass by porch

[illegible]kers #2 and #16 share the same residence.
[illegible]bag located outside of house.
*** Workers #23 and #22 share the same residence.

NOTE -- raw readings given, since there was no formal MULTI-POINT calibration method available for the Jerome 411 these readings should only be used for comparison purposes

TABLE 3

MERCURY STUDY
DOSIMETER TUBE READINGS
TRIP BLANKS

SAMPLE DATE (date started)	Hg conc ug/M3
12/07/88	< (0.10)U
12/08/88	< (0.10)U
12/09/88	< (0.10)U
12/11/88	< (0.10)U
12/12/88	< (0.10)U
12/13/88	< (0.10)U
12/14/88	< (0.10)U

U = Hg was **NOT** detected. The values shown in the parenthesis is the minimum quantitation limit.

TABLE 4

----------PRECISION DATA FOR OLIN MERCURY STUDY----------

#	SAMPLE DATE (date started)	Hg conc ug/M3	
15 Duplicate	12/06/88	2.8	
15	12/06/88	3	6.7 % difference
42 Duplicate	12/06/88	1.78	
42	12/06/88	2.09	14.8 % difference
49 Duplicate	12/12/88	1.5	
49	12/12/88	1.4	6.7 % difference
			9.4 AVERAGE PERCENT DIFFERENCE

TABLE 5

----------COLLECTION EFFICIENCY DATA FOR DOSIMETER TUBES ----------

15 Front	12/06/88	3	
15 Back	12/06/88	0.14	95.3 % COLLECTION EFFICIENCY
42 Front	12/06/88	2.09	
42 Back	12/06/88	0	100.0 % COLLECTION EFFICIENCY
44 Front	12/07/88	2	
44 Back	12/07/88	0.2	90.0 % COLLECTION EFFICIENCY
			95.1 AVERAGE % COLLECTION EFFICIENCY

TABLE 6

MERCURY STUDY
DOSIMETER TUBE READINGS
Olin Chemical Company Study

Homes mistakenly monitored for backgrounds but turned out not to be usable because of homeowners working for Olin or having relatives who worked for Olin and visited regularly

#	SAMPLE DATE (date started)	Hg conc ug/M3
B2	12/10/88	1.10
B5	12/11/88	3.16

2 2 0028

Tony

ERM-Southeast, Inc.

110 • 215 Centerview Drive • P.O. Box 881 • Brentwood, Tennessee 37027 • (615) 373-3350

Site:
Break: 2.2
Other:

April 25, 1989

Mr. James Kopotic
On-Scene Coordinator
Waste Management Division
U.S. Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, GA 30365

Dear Mr. Kopotic:

As per your request, please find enclosed a summary table of the dosimeter analysis for mercury levels in the Yeargin employees' homes which were delineated for cleaning by the Administrative Order issued on December 23, 1988. Additionally, carbon adsorption tube results for certain homes are provided.

If you require additional information or clarification prior to issuance of the entire report pertaining to this project, please contact me at (615) 373-3350 at your convenience.

Sincerely,

ERM-SOUTHEAST, INC.

Tony E. Chatman

Tony E. Chatman
Senior Scientist

Enclosure

TEC:map

ANALYTICAL RESULTS SUBSEQUENT TO CLEANING OF CERTAIN YEARGIN EMPLOYEES' HOMES

EPA ID No.	Name	EPA Sampling Results (ug/m³)	Clean-Up Date	Analysis Date	Dosimeter Analysis Results (ug/m³)
38	(b)(6) Personal Privacy [redacted]	0.57	3/20/89	3/22/89	0.165
11	[redacted]	0.69	3/20/89	3/23/89	0.110
51	[redacted]	2.40	3/21/89	3/23/89	0.251
1	[redacted]	0.99	3/21/89	3/23/89	0.253 0.228 (duplicate)
20	[redacted]	0.71	3/21/89	3/23/89	0.231
4	[redacted]	1.80	3/22/89	3/24/89	0.346
	[redacted]	1.50 1.40 (duplicate)	3/22/89	3/24/89	0.273 0.283 (duplicate)
24	[redacted]	0.61	3/23/89	3/26/89	0.172
2	[redacted]	1.00	3/23/89	3/26/89 3/27/89 3/28/89	0.792* ~~0.402~~ 0.405 [redacted] 0.529 * ~~(duplicate last two results)~~
37	(b)(6) Personal Privacy [redacted]	5.0	3/24/89	3/27/89	0.564 0.575 (duplicate)
			3/29/89 4/6/89 4/12/89 (no cleaning)	3/31/89 4/10/89 4/12/89	0.588 1.80 1.55 2.24 0.24**
			4/13/89	4/13/89	[redacted] .875 * 1.210 0.36**

Next Page

** Carbon Tube results

ANALYTICAL RESULTS SUBSEQUENT TO CLEANING OF CERTAIN YEARGIN EMPLOYEES' HOMES (Continued)

EPA ID No.	Name	EPA Sampling Results (ug/m³)	Clean-Up Date	Analysis Date	Dosimeter Analysis Results (ug/m³)
	(b)(6) Personal Privacy		4/14/89	4/14/89	.580 .584 (duplicate) .260** .260** (duplicate) .200**
34	(b)(6) Personal Privacy	1.10	3/24/89	3/26/89	0.368
22		1.10	3/27/89	3/29/89	0.101
19		≥3.00	3/27/89	3/29/89	Off Scale (≥2.44)
			4/4/89	4/6/89	Off Scale (≥2.44) 14.0**
			4/12/89	4/12/89	0.288 0.314 (duplicate) 0.140**
15	(b)(6) Personal Privacy	≥3.00	3/28/89	3/30/89	0.466 0.518
42		2.10	3/28/89 3/30/89 (no cleaning)	3/30/89 3/31/89	0.793 0.853 0.800 (duplicate)
			4/3/89	4/5/89	1.16 1.21 (duplicate)
			4/7/89 4/11/89	4/10/89 4/11/89	0.641 .537 .554 (duplicate) .170**
32	(b)(6) Personal Privacy	1.40	3/29/89	3/31/89	0.365

ANALYTICAL RESULTS SUBSEQUENT TO CLEANING OF CERTAIN YEARGIN EMPLOYEES' HOMES (Continued)

EPA ID No.	Name	EPA Sampling Results (ug/m³)	Clean-Up Date	Analysis Date	Dosimeter Analysis Results (ug/m³)
7	(b)(6) Personal Privacy [redacted]	1.20	3/29/89	3/31/89	0.366
35		2.10	3/30/89	4/3/89	.700 .657 (duplicate)
			4/5/89	4/7/89	0.531
53		1.00	3/31/89	4/3/89	0.313 0.274 (duplicate)
9		1.60	3/31/89	4/3/89	0.622 0.568 (duplicate)
			4/5/89	4/7/89	0.517
47		0.90	4/3/89	4/5/89	0.385
44		2.00	4/3/89	4/5/89	0.329 0.257 (duplicate)
41		1.10	4/4/89	4/6/89	0.341
14		0.81	4/4/89	4/6/89	0.135
28		1.10	4/5/89	4/7/89	0.308
30		Not Sampled	3/27/89 (no cleaning)	3/28/89	1.27
			3/30/89	4/3/89	0.630
			4/7/89	4/10/89	0.934
			4/11/89	4/11/89	0.514 0.529 (duplicate) 0.340**
10	(b)(6) Personal Privacy [redacted]	Not Sampled	4/12/89 (no cleaning)	4/12/89	0.089 0.073 (duplicate)

(b)(6) Personal [redacted] declined sampling of his house and possible cleaning.
(b)(6) Personal [redacted] declined sampling of his house and possible cleaning.

(b)(6) Personal [redacted] lived in a motel during the time of the incident. EPA indicated that it was not necessary to clean the motel room since any occupant exposure (if any) would be short term.

(b)(6) Personal Privacy [redacted] could not be located during this period of the project. One homeowner indicated to the EPA OSC that he returned to town during the weekend of April 15, 1989.

Tygon tubing had been reattached to the end of the dosimeter during sampling by the home occupant. The validity of the above result is questionable due to this.

Carbon adsorption tube result.

2 4 0001

Olin CHEMICALS

P.O. BOX 248, CHARLESTON, TN 37310
(615) 336-4000

March 2, 1989

CERTIFIED

Mr. Greer C. Tidwell
Regional Administrator
United States Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

Re: Administrative Order No. 88-34-C

Dear Mr. Tidwell:

Enclosed for your approval is the Work Plan revised to incorporate the changes discussed with your staff on February 18, at your Atlanta office. Please forward to me Table I and Attachment A, as provided for on Page 3 of the Work Plan.

If you should have any questions, please contact either me at (615) 336-4212 or J. P. Newman at (615) 336-4234 at this location.

Sincerely,

OLIN CORPORATION

M. L. Norsworthy

M. L. Norsworthy
Plant Manager

MLN/96.JPN/cb

Enclosure

2 4 0002

Site:
Break: 2.4
Other:

PROTOCOL FOR MONITORING AND CLEANING HOMES

Prepared By:

ERM-Southeast, Inc.
PO Box 881
Brentwood, TN 37024-0881

February 27, 1989

Other Office Locations:

Marietta, Georgia
Charlotte, North Carolina
Mobile, Alabama

PROTOCOL FOR MONITORING AND CLEANING

February 22, 1989

INTRODUCTION

The purpose of this protocol is to detail a procedure for identifying, monitoring, and cleaning homes with mercury contamination. This protocol is composed of five components; the first is a list of interested parties and their role in the cleanup operations. The second is a description of the personnel positions to be involved in the cleanup and a list of qualifications for each such position. The third is a description of the actual cleanup procedures to be used at the home. The fourth addresses the concerns of employees and other project details. Finally, waste disposal is addressed.

INTERESTED PARTIES

Note: This section has been included only to show that responsibilities should be spelled out in advance.

Employees

ERM-Southeast will provide a letter, with a copy to Mr. Jim Kopotic, EPA, to the employees/homeowner of cleanup operations. The employees will be responsible for allowing access to their homes, and he or designated representative must be present during the cleanup operations. A home will not be cleaned unless the employee and the homeowner consents to such action. ERM-Southeast will attempt to accommodate reasonable scheduling requests; however, the employees must also be reasonably flexible in permitting access to their homes.

Olin - Olin Will Be Responsible For:

1. Providing ERM-Southeast with the names of those employees whose homes have been designated by the EPA as requiring mercury decontamination per requirements of the Administration Order received by Olin on January 6, 1989.

2. Providing facilities for the storage and/or disposal of any contaminated materials.

3. Providing the financial resources necessary for completing the cleanup. The ATSDR has made available urine testing to all workers' family members. It is assumed that ATSDR will conduct follow up on family members if this is necessary. Workers' expenses for medical testing and follow up should be available and compensated for through Workmen's Compensation.

4. Provide interim results following cleanup of a residence to EPA within 48 hours. A draft report will be issued within 60 days following completion of cleanup activities.

Clean-up Contractor - The Clean-up Contractor Will Be Responsible For:

1. Providing a Nilfisk mercury vacuum system and all necessary cleaning equipment.
2. Arranging for the health monitoring for cleanup personnel.
3. Performing cleanup operations.

U.S. EPA - The U.S. EPA Will Be Responsible For:

1. Providing the list of homes requiring cleaning, including those homes not sampled during the EPA air sampling investigation.
2. Overview ERM's cleaning and subsequent monitoring of the homes following cleaning and reporting the results to the appropriate interested parties defined in the protocol. EPA will be provided the opportunity to oversee this monitoring since they will utilize the data.
3. Asking employees to leave their homes should EPA deem such action as necessary. Olin will also be notified of this action.

ERM - During The Cleanup, ERM Will:

1. Act as a liaison between the homeowners, Olin, the cleanup contractors, and the U.S. EPA.
2. Provide trained cleanup personnel, and supervise their activities during the cleanup.
3. Perform the administrative aspects of the cleanup operation (e.g., notifying the U.S. EPA of homes cleaned).
4. Arrange for any health monitoring for ERM-Southeast employees.
5. Attempt to locate those employees not contacted by EPA during the recent survey. If the employees are located, ERM will sample their homes and determine if mercury is present. Homes found to be above 0.5 ug/m^3 will be cleaned and resampled.
6. Monitoring the homes for mercury levels after cleanup using dosimeters and the Jerome 511 for dosimeter analysis. Jerome 431 monitors will be utilized to monitor the homes for instantaneous on-site results; a Jerome 411 monitor will be available as a backup for the instantaneous sampling.

LIST OF HOMES

Table 1 (must be provided by EPA) summarizes the names and addresses of all homes to be cleaned. A brief description of the mercury levels found in each home during home monitoring is presented in Attachment A (must be prepared). Scheduling homes for cleaning may be difficult given the employees schedules. Thus, to facilitate scheduling, each employee whose house requires cleaning will be asked to submit a list of available times (Table 2 which must also be prepared). This information will be used to generate a schedule.

PERSONNEL AND QUALIFICATIONS

ERM-Southeast will train or supervise personnel in several positions during the course of the project. These positions are listed below. In no instance will minors be employed in any position.

1. Administrative secretary
2. Cleanup personnel
3. ERM-Southeast Project Manager
4. Assistant

Administrative Secretary

The administrative secretary will be responsible for notifying the effected homeowners and arranging for access to their homes. The administrative secretary must be someone familiar to the employees and whom the employees generally respect and trust.

Cleanup Personnel

The cleanup personnel will be responsible for performing the cleaning operations of the project. Cleanup personnel must understand and follow the health and safety and cleaning procedures to be used. At a minimum, cleanup personnel should meet the requirements of 29 CFR 1910.120. 1910.134, and 1910.1200. To ensure that cleanup personnel understand these procedures, cleanup personnel should be able to read and write. Cleanup personnel should also practice good personal hygiene and be courteous. Cleanup personnel will also be bonded. ERM-Southeast personnel will provide the necessary training for these personnel.

ERM-Southeast Project Manger (PM)

The ERM-Southeast PM will perform the administrative aspects of the operation and supervise the cleanup operations. The principal PM must be someone with a degree in the environmental/medical sciences or a related area and must have experience. This person will be Mr. Tony Chatman whose resume is included in Attachment B. Back-up PMs will be

available to relieve the principal PM, as needed. Personnel who may serve as backup PMs include Lisa Hughey, Les Vantrease, Jim Wallace, Mike Meulemans, and Phil Rosten. Their resumes are included in Attachment B also. The latter personnel will be utilized only to relieve the principal PM periodically and in case of unforeseen situations.

Assistant

The "assistant" will assist the PM on a part-time basis in tasks such as xeroxing and running errands.

Personnel Training and Monitoring

All cleaning and supervisory personnel shall have been trained so as to meet the requirements of 29 CFR 1910.120, 1910.134, and 1910.1200 (OSHA regulations). All personnel who will be involved in handling wastes at a secure storage area shall be trained so as to comply with 40 CFR 262.

A pre-project and post-project physical will be given to all workers. This physical will include pulmonary function tests, urine test for mercury, and a neurologic examination (reflexes, tremors, etc.). If the project duration appears as if it will exceed eight weeks, and if homes with an appreciable mercury level (greater than 50 ug/m^3 indicated by mercury dosimeter monitoring) have been cleaned, cleanup personnel will receive a similar examination during the course of the project.

Prior to any work in potentially contaminated homes, all workers will have a brief (half day) orientation on the health and safety, and cleanup procedures to be used. Refresher briefings (approximately 15 minutes) will be held weekly. All personnel will sign a statement attesting to such instruction upon completion of the training. The orientation given to cleanup personnel will include a discussion of the:

1. Exposure routes and toxicity of mercury.
2. Protective equipment to be used.

3. Recommended personal hygiene.
4. Pre- and post-monitoring physical examination.

MONITORING/CLEANUP/DISPOSAL OPERATIONS

The cleanup procedures to be used will depend upon the levels detected and, as such, must remain flexible. A general outline of the procedures to be used, however, is presented below.

Monitoring

Jerome Model 431 mercury vapor analyzers will be used to determine instantaneous levels of mercury in the homes of the employees. The detection limit of the Jerome Model 431 is 3.0 ug/m^3 (according to the manufacturer). A Jerome Model 411 analyzer will be utilized as backup for the 431 monitor. Dosimeters will be analyzed using a Jerome 511 mercury vapor monitor. The limit of detection with the dosimeters is 0.5 ug/m^3.

These data concerning mercury levels in employees' homes have already been collected by the EPA and the data which Olin/ERM does not already have access to should be made available by EPA. The U.S. EPA, Olin, and the employee will be notified of any detectable mercury readings obtained after cleaning.

Protective Equipment

For any home in which a detectable mercury level is found, all personnel will wear: disposable shoe covers, gloves, and coveralls. For homes containing 50 ug/m^3 or greater concentrations as previously determined by EPA using dosimeters, (the NIOSH 10 hr TWA is 50 ug/m^3), half-face respirators, gloves, disposable shoe covers, and poly-coated Tyveks will be worn. The ERM-Southeast Health and Safety Plan delineates the personal protective equipment use in greater detail. Any subcontractors utilized in the cleaning operations should prepare and follow their own Health and Safety Plan which must follow applicable state and federal regulations.

Cleaning Procedures

The cleaning procedures used in the homes of employees will depend upon the levels of mercury detected. No protocol, however detailed, can encompass every situation to be encountered. ERM-Southeast will utilize reasonable cleaning procedures in every home. If mercury concentrations are found $<5\ ug/m^3$ in a particular area in a home, cleanup procedures, consisting primarily of vacuuming with a Nilfisk vacuum will first be used.

The cleanup procedures to be used if mercury levels $\geq 5\ ug/m^3$ are found will depend upon the extent of contamination. If, in the judgment of the ERM-Southeast PM, the mercury contamination is localized (e.g., dust under a refrigerator), then more extensive cleaning procedures than vacuuming will be utilized only in those areas. Washing the contaminated areas with water or a mercury binding solution (e.g., HgX) will be the primary cleaning procedure used. Paper towels will be used to clean the contaminated areas, and all paper towels will be disposed of in the same manner as a controlled waste. Once a paper towel has touched a potentially contaminated area, it will not be placed into the cleaning solution. Thus, any excess cleaning solution will not contact mercury and will not become a hazardous waste. Vacuum cleaners will be decontaminated in the same manner.

If the mercury contamination appears to be ubiquitous, the cleanup procedures will encompass the entire home and may include vacuuming, washing, or dusting all floors, walls, windows, ceilings, and personal possessions.

A general overview of the cleaning procedures is presented below:

Vacuuming - Floors in the home, including closets, will be vacuumed. The floors under furniture will be vacuumed unless: (1) the homeowner does not want furniture moved, (2) movement of the furniture could injure workers or damage the furniture. If contamination is present and the furniture must be moved to eliminate the contamination, the latter exception [(2)] would not apply.

Sink Traps - Sink traps will be drained either by removal of the plumbing fixtures or by placing HgX in the drain and pumping out the drain.

Washing Machines - ERM-Southeast will monitor washing machines, and if detectable mercury concentrations are found, will clean the machine. HgX will be placed in the machine during the wash cycle and the liquid discharge from the machine will be collected and transported to Olin's Charleston facility for disposal.

Shoes - ERM-Southeast will clean shoes, if needed, with an HgX or similar solution, or by vacuuming.

Personal Possessions - During the cleanup, it may be necessary to remove personal possessions from the homes. Clothes, for example, may be contaminated. Clothes would be brought back to Olin and cleaned. The disposition of other items cannot be predetermined and will be determined on a case-by-case basis. ERM-Southeast will work with the employees to minimize inconvenience to the employees.

In the event, the items must be taken from the home, the homeowner will be presented with a receipt for the item. Olin/ERM-Southeast assumes responsibility for return of item, replacement of the item, or compensation for the item. The receipt will show where the item will be stored. Within two weeks, ERM-Southeast will decide if decontamination is feasible. If the homeowner wants the item returned even if the item cannot be decontaminated, the item will be returned if the homeowner will sign a statement acknowledging that the item is contaminated.

Vacuum Cleaners - Vacuum cleaners will be decontaminated in the home, if possible, by (1) appropriately disposing of the vacuum cleaner bag as contaminated material, (2) rinsing (using paper towels) the easily accessible parts of the vacuum, and (3) removing any dust from the vacuum attachments. If the vacuum must be removed from the home, it will be returned or replaced within one week. Replacement parts may be provided if they cannot be decontaminated. Items will be checked by ERM-Southeast to be cleaned before returning the item to the home.

All contaminated cleaning materials will be delivered to Olin in Charleston, Tennessee, for storage, sampling, and disposal at an approved waste disposal site. All contaminated

cleaning materials will be delivered to Olin in plastic bags to facilitate handling of the material. It is ERM-Southeast's understanding that the U.S. EPA by acceptance of this protocol will not require ERM-Southeast or the cleanup contractor to obtain any type of permit or follow any administrative procedures in order to transport the contaminated materials to Olin. Furthermore, the U.S. EPA agrees that the act of cleaning the homes does not constitute the generation of a hazardous waste by ERM-Southeast, or the cleanup contractor and therefore, neither party will be considered a generator nor transporter of hazardous waste. ERM-Southeast will write a letter requesting a waiver from the hazardous waste regulations, if necessary.

Post-Cleanup Inspection

Once per week ERM-Southeast will notify the interested parties of homes ready for inspection and the PM and the U.S. EPA OSC, if available, will inspect the homes cleaned during the preceding week. More frequent inspections (more than once per week) by the U.S. EPA may be needed if such inspections would permit any displaced families to return to their homes. ERM-Southeast personnel will have already surveyed the homes with the Jerome instrument and dosimeter. The dosimeter sampling will commence not sooner than 24 hours after the house cleaning has been completed. EPA's OSC will be notified four hours prior to ERM's clearance sampling for each house and will have the opportunity to be present during the sampling and to participate in the sampling if EPA so desires. In addition to sampling with the Jerome instrument (the utilization of each Jerome model has already been explained), a dosimeter will be placed at the breathing level in the living room of each home and aspirated at a rate of 50 cc/min for 12 hours. ERM will then analyze the dosimeter and determine if any mercury remains in the air after cleaning and the data sent to EPA within 48 hours. Once the data are available, ERM will then notify the homeowner of mercury levels found in the home. If no "hot spots" are found in the homes (e.g., vacuum cleaner, washer) or automobile by use of the Jerome 431(as per page 5, paragraph 9 of the Administrative Order), and the

level (if any) detected by the dosimeter in the living room is $\leq 0.5\ ug/m^3$ (as per page 2, paragraph 7 of the Administrative Order [AO]), the U.S. EPA will review and evaluate the monitoring results for compliance with the AO. If mercury vapor is found at a level in excess of $0.5\ ug/m^3$ by using dosimeters, the home or portions thereof will be re-cleaned.

WASTE DISPOSAL

Overview

All wastes generated during the home cleaning operation will be collected each day and transported to a central secure storage area at Olin for testing to determine if the materials are hazardous wastes. As a precaution, the secure storage area should meet all of the requirements of 40 CFR 262, including the requirements for containers, labelling, and inspection.

Containers

All liquid wastes should be kept in closed top metal drums or plastic carboys in good condition. Cleaning materials (rags, sponges, protective clothing) should be placed in plastic bags (30 gal.) after use. The plastic bags should be placed into open top drums. Solid cleaning materials can be compacted into the drums to reduce the number of drums and associated storage space required.

Sampling

Once in the secure storage area, samples of all liquid should be collected and analyzed for total mercury. If the total mercury concentration exceeds 0.2 ppm, the liquid is hazardous and the drum should be labelled appropriately.

Obtaining representative samples from the solid cleaning materials will be difficult. The cost of segregating cleaning supplies, obtaining representative samples, and analyzing the samples could exceed transportation and disposal costs. For this reason, it is recommended

that all solid cleaning supplies be put in Olin's secure landfill and the containers be labelled appropriately.

Container Labelling

All materials determined to be hazardous materials should be labelled according to the requirements of 40 CFR 262. The hazardous waste number should be listed as D009. The drums should not be labelled with hazardous waste number U151 (a listed hazardous waste), as the materials are not a listed waste. Labeling of material will occur once it is transported to Olin's facility in Charleston, Tennessee.

Transport/Disposal

All hazardous wastes should be transported to a secure TSDF. All hazardous wastes should be disposed of in a RCRA permitted hazardous waste disposal facility.

Non-hazardous wastes may be disposed of in a permitted solid waste disposal facility.

Regulatory Issues

As previously stated, it is assumed that the transport of any of the material back to the Olin facility will not require a transporter's license.[1] It is also assumed that generation of these materials will not cause ERM-Southeast or the cleanup contractor to become a generator of hazardous waste. ERM also assumes that the airing of any of the houses in order to reduce mercury levels will not impact SARA/CERCLA, or Title III for a mercury release. Acceptance of this protocol by the EPA signifies EPA's agreement with the above assumptions.

PROPERTY ACCESS

Non-government personnel do not have legal authority to obtain a warrant to access the property of anyone who does not desire their home cleaned by Olin or representatives of Olin.

[1] Waste will be transported to the Olin facility by either ERM-Southeast or Olin vehicles.

This limitation could compromise the ability to implement an effective cleaning program.

Secondly, some employees may not own their residence, but instead may rent. The owner may not want the house cleaned. Some type of release may be needed.

ATTACHMENT B

The ERM Group

Professional Profile

Tony E. Chatman

Fields of Competence

Development, implementation and management of air pollution and hazardous waste chemical landfill investigations. Monitoring of numerous chemicals released into the atmosphere, surface water and ground water from stationary industrial sources, landfills and mobile sources. Dispersion modeling of pollutants and determination of ultimate fate of chemicals in the enviromnent. Liaison between industry and regulatory personnel regarding chemical emission and permitting of sources in the area of air pollution, surface waters and sewer discharge activities. Measurement of indoor air pollutant concentration pertaining to Occupational Safety and Health Administration (OSHA) guidelines. Experienced in all aspects of the OSHA Right to Know Law and recent SARA amendments.

Experience Summary

Three years experience as the environmental engineer with a major aircraft manufacturer in the Southeast. Negotiated all permits for air, water (NPDES) and sewer; actively engaged in negotiations with local, state and federal regulatory personnel regarding volatile organic chemical (VOC) emission emanating from aircraft paint spraying booths. Experienced in all phases of installation and operation of pollution control equipment. Directed the operation of a million gal/day ion exchange water treatment facility for water reuse in several chemical processing facilities. Responsible for all inhouse environmental audits. Oversaw compliance with state and federal laws pertaining to underground storage tanks and devised a program to monitor and test for leaking of such tanks. Maintained compliance for federal laws pertaining to the operation, removal and disposal of PCB transformers. Responsible for the maintenance and removal, if necessary, of asbestos within the facility. Oversaw the disposal of all hazardous waste via TSDF's (Treatment, Storage and Disposal Facilities).

Seven years experience with environmental consulting firms. Actively engaged in management and logistics of ambient air monitoring of ozone, hydrocarbons, oxides of nitrogen and sulfur, reduced compounds of sulfur, particulates and various other pollutants. On-site selection for establishing ambient air monitoring networks and calibration of continuous instruments for certain of the above pollutants. Modeled air quality and fate of chemicals in the environment. Prepared environmental impact assessments. Permitting to include construction, operation and Prevention of Significant Deterioration (PSD). Provided expert testimony in court cases.

Worked with industries and regulatory agencies in monitoring and assessing of chemicals emitted into the atmosphere, surface water and ground water from hazardous chemical landfills to include sample collection, analysis, data evaluation and report preparation.

Laboratory director for a local air pollution agency for a major metropolitan area. Provided laboratory direction for all aspects of data measurement including wet chemical and continuous techniques. Experience with all aspects of instrumental analysis.

Credentials

(b)(6) Personal Privacy [redacted]

Key Projects

- Evaluation of mercury vapor emissions from soil and multiple point sources for an industrial client in North Carolina.
- Investigation of an abandoned hazardous waste site in Pennsylvania to evaluate the rate of release of volatile organic compounds from the site.
- Air emission testing, ambient air quality monitoring and modeling program for emissions from an organic facility and inactive solid waste disposal site in Tennessee.
- Extended (12 months) ambient air and meterological monitoring and computer modeling of emission from a large thermoelectric facility in Venezuela.
- Design and implementation of a 12-month air quality and meterological testing program to evaluate the impact of emission from steam injection oil extraction facilities in Venezuela.
- Permitting of a new large chemical facility and associated hazardous waste incinerator in New Jersey.
- Ambient air assessment of PBB emissions from a hazardous waste chemical site in Michigan.
- Carbon monoxide and noise monitoring and computer modeling for an environmental statement on highway improvements in Tennessee.
- Preparation of a PSD statement for expansion of a large pulp and paper mill located in the Southeast.

Professional Affiliations

Air Pollution Control Association
Society for Environmental Toxicology and Chemistry
Tennessee Academy of Science

Publications

Author and co-author of four technical papers on environmental pollution, plus numerous presentations at technical conferences.

The ERM Group

Professional Profile

Lisa A. Hughey

Fields of Competence
Engineering and management for hazardous waste projects including investigation and remediation of Superfund sites. ground-water contamination and remediation. Expertise in the collection of samples to provide data regarding the extent of contamination at Superfund sites. Liaison with local. state and federal agencies. and legal counsel.

Experience Summary
Three and a half years experience as a regional manager with a state regulatory agency (TnDHE). Extensive experience in conducting investigation. remediation and monitoring activities at Superfund sites in Tennessee. including working with responsible parties. local. state and federal agencies and legal counsel. Review of investigation and remedial design plans to insure compliance with established design criteria and standards. Extensive on-site work has been conducted which includes installation of monitoring wells. determining sampling points and parameters for which analysis will be performed. collection of ground water. surface water. soil and sediment samples according to EPA approved methods.

Credentials
(b)(6) Personal Privacy

Key Projects
- Conducted Superfund site inspections at over 50 inactive hazardous waste sites.
- Project manager on over 20 Superfund site remedial investigations.
- Project manager overseeing implementation of remedial design at seven Superfund sites.
- Prepared hazard rankings of Superfund sites for the State of Tennessee.
- Project manager overseeing investigation and remediation of contamination caused by leaking underground storage tank at a tank farm in Knoxville. Tennessee.
- Project manager for remediation of a PCB contaminated Superfund site in Tennessee.
- Conducted investigations to determine if imminent hazards existed at three underground storage tank sites in Tennessee.
- Reviewed SPCC plan for industrial client.
- Prepared demolition landfill permit for industrial client.
- Prepared baler permit application for municipality.

Professional Affiliations
American Society of Civil Engineers

Publications
Author or co-author of four papers and presentations dealing with Superfund activities in Tennessee.

Professional Profile

Leslie F. Vantrease

Fields of Competence

Involved in various phases of water quality and biological sampling surveys. This experience includes chemical and microbiological analysis concurrent with surveys.

Experience Summary

Five years' experience including sample collection for biological/chemical water quality surveys in freshwater and marine environments. Specialized testing including complex micro-biological studies, nutrient uptake rate studies, reaeration rate studies, and studies to determine the stripping rate of various compounds from water. Source testing and the ensuing analysis for particulate, sulfate and sulfide. Set-up and maintenance of a high volume network for sampling particulate and particulate lead. Water quality modeling employing one-dimensional models.

Two years' experience in collection of samples to provide information on the extent of contamination at an industrial plant site and the feasibility of making the site environmentally secure, including ground-water, lagoon and soil and sediment sampling used for the determination of the concentration and distribution of environmental contaminants.

Credentials

(b)(6) Personal Privacy [redacted]

Key Projects

- Comprehensive water quality and biological quality investigation and evaluation of a marine bay impacted by an oil refinery in Venezuela.
- Comprehensive water quality investigations and evaluations to be used for water load allocations in an estuary impacted by various industrial facilities.
- Investigation of the ultimate fate of nitrogen compounds in an estuary.
- Evaluation of the impact of a strip-mining operation on the water and biological quality on a basin in Alabama.
- Investigation of the ultimate fate of nitrogen compounds in a waste treatment facility and its receiving stream in West Virginia.
- Monitoring of contaminants in a tidally influenced water system in New Jersey.
- Monitoring of superfund and non-superfund hazardous waste sites throughout the United States.
- Comprehensive investigation of the water quality and biological quality of an extensive impounded river system in Alabama.
- Operation of bench and/or pilot scale industrial wastewater units at facilities throughout the United States.
- On project team that predicted future impacts of hazardous waste sites upon the environment.

Philip Walter Rosten, Jr.

Fields of Competence

Ground water flow and solute transport simulation. Air quality model development and application. Ambient air quality and emission monitoring. Water quality monitoring, evaluation, design and management. Water quality model development for streams, rivers, lakes, and coastal waters. Design operation and technical support of industrial wastewater treatment and pretreatment systems.

Experience Summary

Seven years' experience in design, management and providing technical direction of environmental and resource management projects and proposal preparation. Involved in the preparation of a comprehensive water quality modeling manual.

One year's experience in overseeing the operation of a 5 mgd pretreatment plant for the packing plant wastewater. Aided in the development of a comprehensive plan for reduction in water use.

Two and one-half years' experience providing technical support to the reclamation and wastewater treatment operations of a large integrated oil refinery.

Credentials

(b)(6) Personal Privacy

[redacted]

Key Projects

- Developed a ground water model for the movement of an organic solvent plume migration from a west Tennessee landfill site. Well data taken over a five-year period was analyzed for system response parameters and compared to system response parameters of the numerical model to determine dispersivity and velocity constants that best approximated the existing data. The model was then used to evaluate drinking water concentrations in the period before sampling began and to predict the extent of future contamination.
- A ground water model of mercury transport at a North Carolina plant site was developed. The model was used to evaluate the effect of different flow rates from a contaminant withdrawal well on the plume and the areal extent of the contamination. A model of mercury vapor in the air resulting from plant emissions was also developed for this site as an air emission permit application requirement.
- Evaluation and development of a river water quality management model on the Kanawha River, West Virginia. Evaluated the existing information, sampled, and modeled the Kanawha River System to predict accurate waste assimilative capacity and waste load allocations. Models employed in the investigations were: QUAL II and RECEIV.
- Seasonal waste assimilative capacity of Paint Creek, Ohio. Conducted intensive field surveys, waste assimilative capacity predictive modeling and developed an "equivalent risk" monthly waste load allocation plan. A computer model was installed on the plant's computer system to allow operation of the effluent storage with regulated release treatment scheme.
- Variable discharge with effluent storage plan to control color, Flint River, Georgia. Aided in designing a variable discharge plan with effluent storage based on available river flow to minimize color levels in the river and lake. A computer model was developed and installed on the mill's computer facilities to allow daily operation of the effluent discharge/storage scheme.
- Water quality investigation of the Cumberland River, Tennessee. Project involved obtaining water quality data and updating the original 208 basin plan model.
- Water quality modeling of Amuay Bay, Venezuela. This project involved the assessment of an oil refinery discharge into a tidal bay using a two-dimensional finite difference water quality model.

Professional Affiliations

Water Pollution Control Federation

American Water Works Association

Publications

Author and co-author of nine technical papers and presentations concerning water quality and mixing zone studies in rivers, streams, and estuaries.

ERM-SOUTHEAST, INC.

MICHAEL R. MEULEMANS, P.E.

Registration

Professional Engineer in Tennessee, Iowa and Delaware

Fields of Competence

Design and project management for varied civil and environmental engineering projects. All aspects of project development, including proposals, budget preparation, schedule development, personnel requirements, client management, plans preparation, specifications, and construction and field inspection. Maintaining project conformity to local governing agency requirements as well as client budget constraints. Preparation of preliminary concept development packages and final construction documents, including cost estimates and time requirements, in areas such as wastewater treatment, highway engineering, bridge replacement, traffic impact studies, utility systems, including water, sanitary sewer, gas, telephone, and electricity; site development, including single family residential, multi-family, commercial, medical, governmental, and industrial development; site grading and drainage, earthwork, detention systems, sedimentation and erosion control, irrigation, and swimming pools. Familiar with various computers and software, including coordinate geometry programs, CAD systems, spreadsheets, US Corps of Engineers HEC-1 and HEC-2, US Federal Highway Administration Highway Capacity Manual software, and other design-oriented software, as well as specific programs developed for in-house use. Development of compliance documents for hazardous waste treatment/storage/disposal facilities. Evaluation of existing facilities for regulatory compliance.

Experience Summary

Nine years experience in civil and environmental engineering, both in government and as a consultant. Administered water fluoridation program for Tennessee Dept. of Health and Environment. Involved in project development and preliminary design and cost estimates for a significant number of development projects. Responsible for producing bid and construction documents for many new and existing facilities, including over 25 medical facilities in nine states, over 30 single- and multi-family residential developments and over 20 commercial and industrial developments. Implemented two different CAD systems into the operations of consulting firms. Evaluated existing commercial properties for defects, problems, and regulatory compliance. Developed heliport for commercial office park. Prepared reports and documents such as traffic impact studies, environmental assessments, and closure and post closure plans.

Key Projects

- Evaluation of subsurface contamination at abandoned munitions factory.

- Design of innovative on-site wastewater treatment facility for community hospital in East Tennessee.
- Development of computer-based evaluation methods for siting study for landfill for major metropolitan area.
- Site design for various projects including a county jail, hospitals and medical facilities, a nature center, and a state park.
- Rapid plans development for military exercise at Ft. Campbell, Kentucky.
- Various detention/retention facilities in several different states.
- Project Engineer for 195-acre mixed use planned unit development, which included single-family, multi-family and commercial/office development. This project developed in phases over a 5-year period and included approximately 5 million dollars worth of infrastructure improvements, including a multi-basin detention system designed to reduce post-development downstream runoff rates by 30% or more.
- Part B Permit application for hazardous waste facilities at Ft. Campbell, Kentucky.
- Widening of over three miles of major arterial roadways.

Credentials

(b)(6) Personal Privacy [redacted]

Professional Affiliations

American Society of Civil Engineers
National Society of Professional Engineers
Institute of Transportation Engineers

MR. JIM WALLACE
RESUME

ERM-SOUTHEAST, INC.
215 Centerview Dr.
Suite 110
P.O. Box 881
Brentwood, TN 37027

ERM-Southeast, Inc.

2 4 0023

BIOGRAPHICAL DATA

JIM WALLACE

Date of Birth:	(b)(6) Personal Privacy
Health:	(b)(6) Personal Privacy
Marital Status:	Married
Children:	4
Current Position:	Consultant - ERM-Southeast, Inc., Brentwood, Tennessee
Business Address:	ERM-Southeast, Inc. 215 Centerview Dr. Suite 110 P.O. Box 881 Brentwood, Tennessee 37027 Telephone: (615)373-3350
Education:	(b)(6) Personal Privacy [redacted]
Experience:	1986 - Present Consultant for ERM-Southeast, Inc. 1979 - 1986 Duracell U.S.A - Lexington, North Carolina Manager, Environmental, Industrial Hygiene and Safety Engineering - Responsibilities included identification and monitoring of all hazardous materials in use. Formulated and implemented controls while monitoring their success. Translated waste water standards into required actions and abatement plans. Directed efforts to upgrade present industrial treatment facility.

Responsible for insuring that plant environmental controls functioned, including baghouses, vacuum systems, HVAC systems, hoods, and wet collectors. Duties include inspection, engineering, writing specifications, and purchasing, designed the present industrial ventilation system.

Responsible for budgeting and purchasing, including written justifications and obtaining quotes.

Key member of the Safety and Health Program. Use and evaluation of OSHA code embodied numerous areas from usage of asbestos to radiation producers. Transmitted medical requirements of all operations. Established the need for and type fo PPE. Trained employees in use and maintenance of protective equipment. Wrote company/plant health and safety policy and guidance series. Implemented programs for safety policy and guidance series. Implemented programs for safety glasses, and training in areas of handling chlorine, lifting, hazard communication and forklift operations. Chairperson of Plant Safety Committee.

United States Air Force Chief of Bioenvironmental Engineering Services (1976/Feb. 1979) for McClellan Air Force Base. Was responsible for the surveillance of the industrial environment of approximately 20,000 employees, from the design of facilities to disposal of wastes. This position required an understanding of sanitary engineering, industrial hygeine, health physics, systems safety engineering and numerous other allied disciplines. Directed a staff of three industrial hygienists, ten environmental health technicans and one secretary.

Chief of Occupational Safety and Health Engineering Division (1975/1976) - For McClellan Air Force Base. Provided consultative engineering services to U.S.A.F. bases in 22 states in the field of noise control, industrial hygeine, industrial ventilation, PPE. Supervised four engineers and numerous engineering technicians.

Chief of Bioenvironmental Engineering Services (1974/1975) - At the U.S.A.F. Hospital, Utapao, Thailand. Responsibilities were equally divided between occupational health, environmental management and preventive medicine.

Chief of Bioenvironmental Engineering Services (1971/1974) - At U.S.A.F. Rocket Propulsion Lab - Edwards Air Force Base. Addressed numerous potential hazards including diffusion of emissions, sensitive and toxic chemicals, cryogenics, high pressures and temperatures, heat stress, high voltages, and routine industrial problems emanating from fabrication and maintenance operations. Formulated research programs and directed ongoing efforts.

Chief of Air Engineering Division of U.S.A.F. Environmental Health Lab McClellan Air Force Base (1967/1971) Provided consultative engineering services Air Force wide in evaluation and control of air pollutants. Supervised three engineers, one air pollution meterologist, two allied scientists and numerous technicians.

Student (1965/1967) - Completed program specifically tailored to meet diverse educational requirements of Bioenvironmental engineering.

Staff Bioenivronmental Engineer - Torrejon A.F.B., Spain. (1962/1965) - Provided consultant services in occupational safety and health to thirteen Air Force installations.

Base Sanitary and Industrial Hygiene Engineer - Channault A.F.B. (1958/1962) - Worked in the areas of industrial hygiene, sanitary engineering, health physics and public health.

Professional Certificates: Professional Safety Engineer, State of California. Certified Hazard Control Manager, International Hazard Control Managers.

Professional Organizations: American Conference of Governmental Industrial Hygienists.

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DETAILED PROTOCOL FOR MERCURY INDOOR AIR SAMPLING

Prepared By:

ERM-Southeast, Inc.
PO Box 881
Brentwood, TN 37024-0881

February 22, 1988

Other Office Locations:

Marietta, Georgia
Charlotte, North Carolina
Mobile, Alabama

DETAILED PROTOCOL FOR MERCURY INDOOR AIR SAMPLING

INTRODUCTION

Certain residents may have mercury levels in their homes. These residents in question alledge to have contaminated their homes with mercury through their work activities.

The objectives of this mercury air sampling protocol are as follows:

1. To determine the relative magnitude and concentration of mercury in the homes.
2. To provide consistent and representative procedures for sampling between different homes and vehicles.
3. To demonstrate adequate removal of mercury from the homes.

Items 1 and 2 have already been accomplished in the recent EPA mercury sampling survey.

INSTRUMENTATION

The following describes procedures for use of the Jerome 411 and 431 Gold Film Mercury Vapor Analyzers and Jerome mercury dosimeters. This procedure is also appropriate for utilization with the Jerome 511 Gold Film Mercury Vapor Analyzer.

1. Prior to use, the analyzer should be subjected to the Film Heat procedure in the appropriate manual. The bridge balance should be adjusted not sooner than one hour after the Film Heat procedure, according to published guidelines.
2. Sixteen hours of battery charging are required to completely charge the battery of the analyzer.
3. The flow rate of 750 cc/min across the gold film should have been checked within the last three months either by the analyst or by the factory. The procedure for flow testing and for flow adjusting are provided in the manual.
4. The analyzer should have been factory calibrated within the last three months. Daily, a functional test procedure should be performed by the analyst to insure that the analyzer

is performing correctly. This procedure does not replace a recent factory calibration but only indicates that the analyzer is detecting a level of mercury.

5. The intake filter disc should be replaced after 20 hours of sampling or more frequently if dust is visible.

6. Since the instrument operates by changing the resistance of a gold foil, drastic changes in the temperature of the instrument should be avoided during sampling. The instrument should be allowed to equilibrate when sampling in rooms of significantly different temperature. Similarly, care should be taken when sampling near hot or cold areas (i.e., space heaters, wood burning stoves, etc).

7. Analysts using the Jerome instrument should touch a metal object (door knob, i.e.) to discharge static electricity between readings.

8. The Jerome instrument should not touch an object being sampled such as a rug; the monitor may be brought in close proximity to the object being sampled.

9. The Jerome 411 and 431 instrument should be utilized in the sample mode (10 sec sampling) to determine mercury levels. Areas such as carpeting, closets, drains, vacuum cleaners, washing machines, etc. should be checked. For vacuum cleaners, the one-second survey mode is recommended for monitoring to prevent overloading the gold film. The vacuum cleaner should not be operating during this sampling.

10. The analyst should periodically take proximity readings of his/her clothes and shoes to ensure that trace levels on the analyst's clothes are not a source of mercury.

11. Prior to use of any dosimeter, the dosimeters should undergo complete desorption of adsorbed mercury according to published procedures.

12. The low flow sample pumps should be calibrated using a flowmeter which has been calibrated against an appropriate NBS standard. The flow rate should be 50 cc/min.

13. A mercury dosimeter should be placed at the breathing level in the living room in each home and air aspirated through them at a rate of 50 cc/min for a period of 12 hours.

14. After completion of the dosimeter sampling, desorption of the mercury should be done according to Jerome published procedures. Each dosimeter should be desorbed three times to ensure that all mercury is removed and the results added.

MONITORING PROCEDURES

Monitoring should identify and document the presence of any mercury in the homes. Identification and documentation are equally important. The purpose of identification is to locate any mercury bearing areas of a home. The location of these areas must be documented so that further actions as needed can be planned. To accomplish both goals, the following steps should be implemented.

1. Ambient air readings should be taken in each room by holding the Jerome at chest level and walking through the room while collecting a sample (ten-second sampling mode). At least three such readings in each room should be collected. The analyst should discharge static electricity between readings.
2. Proximity (near surface), mercury readings should be taken in each room. Indoor areas to be checked are:
   a. floors/carpeting;
   b. upholstered furniture;
   c. furnace intakes;
   d. vacuum cleaners;
   e. shoes;
   f. any outdoor rugs (i.e. welcome mats);
   g. closets;
   h. clothes hampers;
3. The air temperature in each room, or series of connected rooms, should be measured and recorded. Note if the windows are open or closed.

4. Proximity readings should also be collected from the floorboards of all vehicles. The air temperature should be at least 70°F. This air temperature can be achieved by parking the car in full sunlight, in a heated garage, or by running the car with the heater on. When entering the car to monitor it, enter quickly from a rear door, if possible, to keep the temperature warm on the front seat floorboards. The trunk should also be measured if the air temperature in the trunk can be raised to 70°F.

   When monitoring the car, make sure the Jerome is at roughly the same temperature as the interior of the car.

5. Sketch an approximate floor plan of the house (to scale as best as possible). Also, sketch the approximate layout of each room, including furniture. Record the location of detectable and non-detectable mercury readings on the room sketch.

6. Note the presence of any porous building materials such as ceiling tiles, exposed insulation, or masonry (cinder block) walls.

7. Note the presence of any fluorescent lamps, chlorine bleach, or other potentially mercury bearing items in the home.

8. Determine the occupation of all residents of the home.

9. When monitoring bathroom areas, note the existence of any mercury thermometers. Do not conduct a search, however.

10. Note the general housekeeping practices (messy vs. neat, clean vs. dirty). Record any positive or negative comments made or any questions asked. Answer all technical questions to the best of your ability. Be factual and do not guess. Follow-up immediately on any questions you cannot answer when in the home.

11. Describe the floor and wall coverings in each room. Are the floors wood, linoleum, tile, covered with rugs or carpet?

Are the walls panelled, wall papered, or painted, are the walls/ceilings constructed of wall board or plaster?

12. Record location of all physical samples (not air readings) collected. Give a receipt for all items removed from a home.

13. Note the types and location of all heating systems.

DOCUMENTATION

Record all observations in a bound field notebook, number all pages sequentially. Use an indelible ink for all notations. Mark through all corrections with one single horizontal line; do not erase or black out. Initial all corrections and record date and time.

Before leaving the home make sure all notes are legible. Give the homeowner a receipt for any items removed from the home.

NOTE:

Post air sampling to be conducted at normal ambient temperature (approximately 68°F) with the windows closed. Homes need to be closed up for 24 hours prior to conducting sampling.

2 4 0036

File:
Break: 2.4
Other:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

MAR 2 3 1989

Phil Newman
Olin Corporation
P.O. Box 248
Lower River Road
Charleston, Tennessee 37310

Re: Olin/Yeargin Mercury Release
U.S. EPA Administrative Order No. 88-34-C

Dear Mr. Newman:

As previously discussed during our telephone conversation on March 16, 1989 the following addresses the final work plan and your questions regarding the cleanup of homes.

- US-EPA concurs with the cleanup work Plan (final).

- US-EPA and the Tennessee Department of Health and Environment will not require any special permits or licensed waste hauler, to transport the contaminated materials resulting from the cleanup of homes, to the Olin facility in Charleston Tennessee for disposal in the RCRA permitted waste landfill.

- The Jerome meter 431 is acceptable for analyzing the dosimeter tubes.

- US-EPA has no objection to collecting a dosimeter tube prior to cleaning a home. Following cleanup, a dosimeter tube will be collected to ensure that the mercury contamination has successfully been removed to the recommended safe level (0.5 ug/m^3 or less).

- The list of twenty-five homes to be cleaned is included in this letter (attachment 1). Those homes not sampled by US-EPA during the sampling investigation conducted during November and December, 1988 are included in this letter (attachment 2). Those homes not sampled by US-EPA will need to be addressed by Olin during the cleanup activities.

I have included a copy of the Yeargin employee roster that will provide the employee's telephone numbers and addresses. Should you have any other questions, I can be reached at the Holiday Inn, Athens, Tennessee at 745-1212, or you can contact my supervisor Mr. Bob Jourdan at 404/347-3931.

Sincerely yours,

for

James Kopotic
On-Scene Coordinator

ATTACHMENT 1

Homes exceeding 0.5 ug/m^3:

(b)(6) Personal Privacy

37
15
19
51
35
42
44
4
9
49
7
22
28
34
41
2
53
1
47
14
20
11
24
38
32

ATTACHMENT 2

Homes not sampled by US-EPA:

10 (b)(6) Personal Privacy - was not located
12 - " " "
13 - " " "
45 - " " "
29 - Did not want EPA to survey home.
30 - " " " " " " "

Note: Residence # 16 (b)(6) Personal Privacy same as # 2 (b)(6) Personal Privacy
and # 23 (b)(6) Personal Privacy same as # 22 (b)(6) Personal Privacy

Site:
Break: 2.8
Other:

2 0 2001

OLIN CHEMICAL COMPANY

CHARLESTON, TENNESSEE

NOVEMBER 17, 1988

Agency for Toxic Substances and Disease Registry
U.S. Public Health Service

PRELIMINARY HEALTH ASSESSMENT
OLIN CHEMICAL COMPANY
CHARLESTON, TENNESSEE
NOVEMBER 14, 1988

Prepared by:
Office of Health Assessment
Agency for Toxic Substances and Disease Registry

Background

On August 22, 1988, employees of the Yeargin Construction Company were contracted by the Olin Chemical Company to replace some pipes and fittings in cell house 812 at the Olin Plant. In the cell house, the workers reported seeing pools of mercury 3-4 inches deep on the floor. The available protective clothing consisted of disposable Tyvek suits, rubber half-boots, and cartridge respirators. The workers used oxyacetylene torches to cut pipes in the room. Some of the pipes reportedly contained standing mercury, and it was necessary for the workers to use their torches to volatilize the mercury before the pipes could be heated enough to cut. According to worker accounts, the volatilized mercury would condense at the ceiling of the room and fall back to the floor as mercury "rain". Workers reported that their gloves, clothes, and boots became soaked with mercury. The work period lasted from 7:30 a.m. to 12 midnight, so some workers may have been exposed for as long as 16.5 hours. At the end of the workday, the workers reported that they were denied access to the Olin facility showers.

The workers returned home in their personal vehicles. On the way home, some workers became ill and reported vomiting. Since the workers' clothes and tools were visibly contaminated with mercury, it is likely that mercury contamination of their vehicles and residences resulted. One worker reported pouring pooled mercury from his boots down the sink drain at home. Washing machines at the workers' homes were used to launder work clothes.

As a result of the extensive exposure to mercury in the Olin Facility, many of the workers developed symptoms of mercury toxicity and sought medical treatment. Three of the men reported episodes of violent behavior which were not typical of their normal behavior patterns. In some of the men, urine samples collected 1 month after the initial exposure still contained an elevated concentration of mercury. An undetermined number of affected workers were hospitalized and have received chelation therapy from Dr. Andrew Heath at the Vanderbilt University Medical Center.

This Preliminary Health Assessment is based on information obtained from (1) U.S. Environmental Protection Agency - Region IV (EPA) and ATSDR regional staff, and (2) EPA memorandum: Air monitoring results from Mercury screening of Olin construction workers' homes, Danny France to Bob Jourdan, November 8, 1988.

Environmental Contamination and Physical Hazards

On November 2-4, 1988, the Environmental Services Division of the EPA, Region IV, screened 6 homes of affected workers for possible mercury contamination. A Jerome Model 511 Analyzer, which provides an instantaneous readout of air mercury concentrations, was used to locate mercury hot spots.

In living areas in the homes, air mercury concentrations ranged from below detection (2 ug/m^3) to 5.9 ug/m^3. However, hot spots were detected in the homes in locations such as over the washing machine tub (54 ug/m^3) and over the sink (7.0 ug/m^3). In addition, elevated air mercury concentrations were detected inside workers trucks (8.1 - 10 ug/m^3).

Air samples were also collected from living quarters over an 8-hour period using a dosimeter collection tube and pump. Using this technique, air mercury concentrations of 1.0-5.0 ug/m^3 were detected.

This air monitoring was conducted more than 2 months after the mercury contamination had occurred. During this time, it is likely that some of the mercury in the homes had been removed by cleaning, vacuuming, volatilization and dissipation in the air, etc. Therefore, it is likely that the initial air mercury concentrations were higher than current levels, but no information on the original air concentrations is available.

Officials from the Tennessee Occupational and Safety and Health Administration have reportedly surveyed the workers and monitored for mercury in their homes, but their findings were not available for review.

Potential Environmental and Exposure Pathways

Metallic mercury volatilizes to a vapor at ambient temperatures. Mercury vapor readily diffuses across the alveolar membranes of the lungs, and it has been estimated that 80 percent of inhaled metallic mercury is absorbed by humans. To a lesser extent, mercury may also be absorbed through dermal contact with elemental mercury. After absorption, mercury is slowly eliminated from the body by urinary and fecal excretion. The biological half-life of mercury vapor appears to be in the range of 35-90 days.

The recent detection of mercury in air from the homes of affected workers demonstrates that mercury contamination of the homes is still present. During cold weather, the doors and windows of homes are usually kept closed to prevent the loss of heat. Under these conditions, the exchange of air between indoors and outdoors would be reduced, and this could result in an increase in indoor air concentrations of mercury.

Demographics

It was estimated that 24-27 workers were exposed to mercury contamination at the Olin Facility during the pipe cutting episode. These workers live within a 40-45-mile radius of the Olin Plant. Although little demographic information is available, it is known that some of the workers are married and have children at home. Some of the workers reportedly live in trailers.

Evaluation and Discussion

The most consistent and pronounced effects of inhalation exposure to mercury vapor are on the central nervous system. A spectrum of neurological and psychological effects may develop which can include depression, irritability, exaggerated response to stimulation (erethism), excessive shyness, insomnia, emotional instability, etc. The classic neurological manifestation of mercury toxicity is a tremor of the muscles that perform fine-motor functions, such as the fingers, eyelids, and lips. Nonspecific symptoms such as anorexia, weight loss, and muscular weakness may also occur.

Many of the exposed workers experienced these classic symptoms of mercury toxicity and have undergone chelation therapy to accelerate the elimination of mercury from their bodies. These individuals should avoid any further exposure to mercury, since this would contribute to their body store of mercury and prolong their recuperation.

Other family members in the affected homes are also being exposed to mercury contamination. Since elemental mercury can cross the placenta, a fetus may also be exposed to mercury from its mother's blood.

In the 6 homes tested, the 8-hour air concentrations of mercury ranged from 1.0-5.0 ug/m^3. The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) have recommended that workplace concentrations of mercury should not exceed 50 ug/m^3 over an 8-hour period. However, it is not appropriate to apply this value to a residential situation since: (1) occupational exposure applies to an 8-hour day and a 5-day week; in the home, exposures may occur 24 hours a day and 7 days a week, and (2) the occupational exposure recommendations apply only to workers; this exposure may not be protective of sensitive segments of the population such as the young, the old, or the ill. Therefore, acceptable exposures to mercury in the home should be set well below the ACGIH and NIOSH values.

In the 1986 Superfund Public Health Evaluation Manual, the EPA recommended that chronic exposure to mercury in air should not exceed a concentration of 0.18 ug/m^3. This value was derived by correcting the recommended occupational exposure value for an assumed continuous exposure and incorporating a 100-fold uncertainty factor.

Conclusions and Recommendations

Based on the available information, this situation is considered to be of public health concern because of the risk to human health resulting from the inhalation of mercury vapors in the private residences of the exposed workers. Prolonged exposure to the maximum concentration of mercury detected in indoor air samples would pose a significant health risk for previously exposed workers and other family members.

Therefore, the following recommendations are made in order to protect the public health.

(1) All of the homes and vehicles of workers that were involved in the described incident should be evaluated for mercury contamination using an acceptable sampling protocol, analytical methodology, and appropriate quality analysis/quality control procedures.

(2) All of the homes identified to date, as well as other homes which demonstrate mercury contamination, should be immediately cleaned to remove residual mercury. Special attention should be given to washing machines, sink drains, showers, rugs, and other areas where elemental mercury may have lodged. Following cleanup, air mercury concentrations in the homes should not exceed the detection limit (0.5 ug/m^3). Vehicles should also be checked and cleaned, if warranted.

(3) Family members residing in mercury-contaminated homes should be tested for mercury exposure by urine or blood analyses. Such testing is particularly indicated for individuals with symptoms of mercury toxicity. Appropriate medical evaluation and monitoring should be initiated for those individuals identified with abnormal results.

(4) The incident has been brought to the attention of Federal NIOSH officials, and we suggest involvement of Occupational Safety and Health Administration at an appropriate time. Investigations should include an evaluation of the cell house where the mercury release occurred in order to determine if further mercury exposure is possible.

Data obtained from future environmental testing and biomonitoring should be forwarded to ATSDR for evaluation. This information will form the basis for further assessment by ATSDR as warranted by public health issues.

ADDENDUM
PRELIMINARY HEALTH ASSESSMENT
OLIN CHEMICAL COMPANY
NOVEMBER 23, 1988

ATSDR's recommendations for the protection of the public health at the Olin Chemical Company site were presented in the Preliminary Health Assessment of November 17, 1988. In these recommendations it was stated that the affected homes should be cleaned up to an indoor air mercury concentration of 0.5 ug/m^3 or less. This concentration is equivalent to the detection limit of the Jerome Model 511 Analyzer using an 8-hour collection sample. In addition, this concentration would be protective of human health, and no adverse health effects would be expected to result from exposure to air mercury concentrations below this value.

In order to be representative of human exposure, the air sample should be collected at the level of the breathing zone in a living area of the residence. The doors and windows of the home should be closed during sampling to reduce indoor-outdoor air exchange, and a normal room temperature should be maintained.

It is also recommended that residents of homes with mercury contamination be tested for urine mercury concentrations. This information would be important in identifying individuals who may need clinical evaluation or treatment. In addition, this information, in conjunction with the air monitoring data, would be valuable in documenting that exposure has occurred.

REGIONAL RESPONSE TEAM
FEDERAL REGION IV 2 8 0007

Site:
Break: 2.8
Other:

Environmental Protection Agency
United States Coast Guard
Department of Commerce
Department of the Interior
Department of Agriculture
Department of Defense
Department of State
Department of Justice
Department of Transportation
Department of Health and Human Services
Federal Emergency Management Agency
Department of Energy
Department of Labor
Tennessee Valley Authority
Nuclear Regulatory Commission
State of Alabama
State of Florida
State of Georgia
Commonwealth of Kentucky
State of Mississippi
State of North Carolina
State of South Carolina
State of Tennessee

INCIDENT-SPECIFIC RRT ACTIVATION:

Jim Kopotic, On-Scene Coordinator, EPA, is requesting the Regional Response Team convene on **Friday, November 18, 1988**, at 9:00 a.m., at the EPA Regional Office in Atlanta, at 345 Courtland Street. The meeting will be held in the 14th floor Small Business Administration conference/training room in the Tower Building.

PURPOSE:

The purpose of the meeting is to discuss future responses and investigations relating to a mercury release and worker exposure at the Olin chlor-alkali facility, Charleston, Tennessee. The release occurred on August 22, 1988. Numerous Yeargin construction workers were exposed to high concentrations of mercury vapor and elemental mercury which was then transported to their homes. Preliminary air monitoring data of six of the workers' homes revealed the presence of mercury.

Initial concerns by the OSC include worker and family exposure, necessary clean-up of homes and work places, potential releases of mercury to other parts of the environment, and release notifications. Because of the breadth of this release and its potential impact on public health and the environment, we are requesting that all interested agencies represented on the RRT attend the meeting. We are specifically requesting that HHS, DOI, FEMA, DOL, TVA and the State of Tennessee provide representatives.

Additional information will be provided at the meeting. Please feel free to contact Jim Kopotic, if you need additional technical information or Cynthia Peurifoy if you need additional logistical information. Both can be reached at 404/347-3931, FTS 257-3931.

Robert F. Jourdan, III
Co-Chair, Federal Region IV RRT

Commander (m), Seventh Coast Guard District
909 S.E. First Ave., Rm 703, Miami, FL 33131-3050
(305) 536-5651 FTS 350-5651

Chief, Emergency Response and Control Section
U.S. Environmental Protection Agency, Region IV
345 Courtland St., Atlanta, GA 30365
(404) 347-3931/FTS 257-3931

James Kopotic
8-14-89

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

2 8 0008

REGIONAL RESPONSE TEAM MEETING
FEDERAL REGION IV
ATLANTA, GEORGIA
NOVEMBER 18, 1888

OLIN CORPORATION MERCURY INCIDENT
CHARLESTON, TENNESSEE FACILITY

AGENDA

I. Chronology of Events and Summary of Available Information

II. Identification of Problems and Concerns

A. Public Health

1. Exposed Workers

2. Family Members

3. Plant Personnel

B. Environment

1. Exposed Worker's Homes

2. Contamination On-Site at the Olin Facility

a. Surface and Subsurface Soils

b. Groundwater

3. Contamination Off-Site

a. Surface and Subsurface Soils

b. Groundwater

c. Hiawassee River

III. Formulate a Systematic Plan to Fill Data Gaps and Address Public Health and Environmental Concerns

Chronology of Events

On October 24, 1988, (b)(6) Personal Privacy a Yeargin Company employee, notified the EPA through the National Response Center of an incident which occurred on August 22, 1988. Mr. Jim Kopotic, an OSC for EPA, took the call. (b)(6) (b)(6) claimed that he and 27 other Yeargin crew members were exposed to mercury while replacing header pipes in the cell building of the Olin Corporation plant in Charleston, Tennessee. (b)(6) stated that as a result of this exposure he was under the medical care of Dr. Andrew Heath at the Region Middle Tennessee Toxicology Center. (b)(6) was concerned that he may have contaminated his home with mercury that was on his work clothes. He expressed concern for his wife's health as a result of mercury exposure from contamination in their home. Following the conversation with (b)(6) Personal OSC Kopotic contacted Chuck Pietrosewicz of ATSDR and requested assistance. Both agencies began searching for available background information.

On October 26, 1888, ATSDR Emergency Response Branch was briefed on the situation. Based upon preliminary medical and background information, ATSDR informed OSC Kopotic that a potential serious exposure incident had occurred and that additional information was needed before the situation could be completely evaluated. OSC Kopotic informed ATSDR that he would coordinate an air sampling survey of several of the homes. OSC Kopotic contacted Mr. Danny France, EPA/ESD Air Compliance Section and requested air monitoring for mercury vapors in several of the worker's homes. OSC Kopotic contacted Mr. Norman Elkins of Tennessee OSHA, who had conducted previous air sampling of the homes. His results showed levels of mercury vapor in the range of 2.0 to 7.0 ug/m^3.

From November 1-4, 1988, an air monitoring survey was conducted by Jim Kopotic, Danny France, and Jerry Burger of EPA and Chuck Pietrosewicz of ATSDR. The homes sampled were randomly selected from a list of exposed workers that was prepared by (b)(6) Both instantaneous and continuous air measurements were taken. Instantaneous results showed mercury levels from non-detectable to 53.8 ug/m^3. The eight hour continuous dosimeter tubes showed levels from 1.0 to 5.0 ug/m^3. Interviews conducted by Mr. Pietrosewicz and OSC Kopotic revealed the following scenario:

> On August 22, 1988 Yeargin construction workers entered the cell building 812 of the Olin Corporation in Charleston, TN to replace cell header pipes. Upon entering the work area, the workers noticed pooled mercury several inches deep all over the cell floor that was being contained across the doorway by a sand dike. Olin safety personnel notified Yeargin workers that all work Permits had been issued and to begin work. When questioned on safety issues, Olin safety personnel indicated that rubber boots and tyvex coveralls were required; respiratory protection was not required. The work by the Yeargin employees consisted of cutting pipes with oxygen/acetylene torches. These pipes were half full of mercury and as the cuts were made, hot mercury flowed out of the pipes. No monitoring was conducted by the Olin personnel during the work activities.

An Olin employee commented to a Yeargin worker that he was shocked that while work was being conducted in the cell building, Olin safety personnel were monitoring the air on the floor above the cell room for mercury. Several of the workers donned respirators, even though they understood they were not required, because their throats were burning and the smoke was choking them. They stated that mercury was splashing all over them. Their gloves, clothes and boots became soaked with mercury. Also workers reported that volatilized mercury would condense on the ceiling and fall back to the floor as a mercury "rain". Several workers had to leave early because they felt they had the flu. One worker reported he had to stop several times on the way home to vomit. His wife stated that he had a fever of 103 degrees and would not go to the doctor because he was too sick to get out of bed. The work lasted approximately 16 1/2 hours. At the end of the work the Yeargin employees were denied access to the Olin personnel hygiene/decon facility because it was Olin's plant policy that only plant personnel were allowed access to these facilities.

On August 23, 1888, the Yeargin crew returned to the cell building to remove pipes and equipment. They were met by Olin safety personnel. They required Yeargin workers to don respirators as the building was now posted. When asked why they needed to wear respirators the second day but not the first when all the work was conducted, Olin personnel stated that the mercury levels had gone up.

APPENDICES

I. EPA Region IV Notification Report

II. EPA Air Monitoring Results (November 1988)

III. ATSDR Draft Health Assessment (November 1988)

APPENDIX I

REGION IV INCIDENT NOTIFICATION REPORT

1. Case No.: _____

2. Reported: (mm/dd/yy) 10/24/88 | 3. Time: 1130 | Recorded By: Kopotic

4. ☐ Through NRC: | 5. NRC Case No.: | 33. Spill Date: 8/22/88 | 34. Spill Time:

A. REPORTER

6. Reported By: (b)(6) Personal Privacy [redacted] 2 8 0013

7. Organization Name: [redacted]

8. Organization: ☐ 9. discharger ☐ 10. public ☐ 11. state ☐ 12. local ☐ 13. federal

14. Address: (b)(6) Personal Privacy [redacted]

15. City: [redacted] | 16. County: | 17. State (b)(6) Personal [redacted]

18. Zip: [redacted] | 19. Phone (b)(6) Personal Privacy [redacted]

B. DISCHARGER

20. ☐ As Above in A if 9 applies | 21. Name: Olin Chemical Corp.

22. Address: Lower River Rd.

23. City: Charleston | 24. County: | 25. State Tn

26. Zip: 37310 | 27. Phone: (615) 336-4511

C. INCIDENT LOCATION

28. ☒ As Above in B | 29. Street or Approx. Location: 812 Cell Bldg. - Olin Plant

30. City: | 31. County: | 32. State

E. MATERIAL

Material: ☐ oil ☐ hazardous substance ☐ other	35. Material Unknown	UN/DOT No	CAS No.	CHRIS Code	Quantity Spilled	Amount Entered	Units (Circle 1)	> RQ
36. Mercury		37.	38.	39.	40.		41. lb. gal. bbl. oth	☐
42.		43.	44.	45.	46.		47. lb. gal. bbl. oth	☐
48.		49.	50.	51.	52.		53. lb. gal. bbl. oth	☐

G. MED.

Medium Affected: ☒ 63. air ☒ 64. land ☐ 65. water ☐ 66. groundwater ☐ 67. within facility only

68. Waterway Affected: | Tributary To:

F. SOURCE

Source of Spill: ☐ 54. highway ☐ 55. air transport ☐ 56. railway ☐ 57. vessel ☒ 58. fixed facility ☐ 59. pipeline ☐ 60. offshore | 61. Vehicle ID or Carrier No.: _____

62 & 76. Description:

H. CAUSE

Reported Cause: ☐ 69. transportation accident ☐ 70. equipment failure ☐ 71. operational error ☐ 72. natural phenomenon ☐ 73. dumping ☐ 74. unknown ☐ 75. other

I. DAM

Damages: 77. no. of injuries _____ 78. no of deaths _____ ☐ property damage > $50,000

J. ACTIONS

80. ☐ Evacuation | 81. Response Action Taken:

K. NOTIFIED

Caller Has Notified: ☐ 82. state/local ☐ 83. discharger ☐ 84. USCG ☐ 85. other ☐ 86. unknown

Agency Name

L. COMMENTS

87. Comments (b)(6) Personal Privacy [redacted] was employed by Yeargin Inc. who was contracted by Olin to replace pipes in facility. While working in 812 Cell Bldg. (b)(6) Personal Privacy [redacted] was exposed to mercury as was the other crew members. (b)(6) Personal Privacy [redacted] claimed there is 27 families that have been exposed to mercury from the job. (b)(6) Personal Privacy [redacted] transported mercury from ☒ Additional Information

M. REGIONAL DATA FIELDS

Responding Agency: ☐ state ☐ local ☐ discharger ☐ federal ☐ EPA ☐ TAT ☐ unknown

Agency Name:

Responder (Contact):

EPA has notified: ☐ state ☐ local ☐ USCG ☐ RRT ☒ referral (see Section N)

N. [illegible]

CWA:			CERCLA:		None:	Referred to:				
309	☐ o	☐ c	103c	☐	☐		NPDES	☐	FEDFAC	☐
308c	☐ o	☐ c	104	☐			TSCA	☐	RCRA	☐
							WATER	☐	OTHER ATSDR	

the plant to his residence (b)(6) Personal state Tn-OSHA conducted an investigation at his home and mercury vapor was detected [redacted] his carpet, floors, washer, truck, lunch box, etc (b)(6) Personal (b)(6) Personal stated that when he got home from work that he found elemental mercury in his pants pockets. He is seeing Andrew Heath, MD, at the Region Middle Tn. Toxicology Center (615/343-6280) about his medical condition.

Note: Contact for Tn-OSHA that conducted investigation is Norman Elkins - Chattanooga, Tn. 615/634-6408

APPENDIX II

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA 30613

MEMORANDUM

DATE: November 8, 1988

SUBJECT: Air monitoring results from Mercury screening of Olin construction worker's homes

FROM: Danny France
Air Compliance Section

TO: Bob Jourdon, Section Chief
Emergency Response and Control Section
Waste Management Division

Enclosed are the results from the air toxics monitoring that we performed in the Charleston, Tennessee area last week. We monitored in six of the homes of construction workers who were exposed to high levels of mercury at the Olin Chemical Plant (located near Charleston, Tennessee). Jim Kopotic of your section and Chuck Pietrosewicz of ATSDR observed the monitoring and analysis and conducted interviews of the people who had been exposed and their families.

In general, we found either no detectable concentrations of mercury or only extremely low concentrations of mercury in the ambient air inside of the homes. However, we did find some hot spots inside the homes where clothing worn at the Olin plant had been stored, inside work vehicles, inside washing machines that were used to launder work clothes, etc. Even these areas however only had low level contamination. If you have any questions about this report please feel free to call either Jerry Burger or me at FTS-250-2207

cc: Mike Carter
Doug Lair
Jim Finger
Chuck Pietrosewicz
Jim Kopotic

Olin Chemical Mercury Study
Charleston, Tennessee

INTRODUCTION

In response to a request from the Emergency Response and Control Section of the Waste Management Division, the Environmental Services Division screened six houses (located near the Olin Chemical plant in Charleston, Tennessee) for possible mercury contamination during November 2-4, 1988.

BACKGROUND

Approximately three months ago employees of a contractor hired by Olin Chemical were contaminated by mercury while replacing some pipes and fittings in one of the cell houses at the Olin Chemical plant. The construction workers were using cutting torches to cut through pipes containing elemental mercury. The only safety equipment that was used were cartridge type respirators and disposable Tyvek suits that were supplied by the company. This proved to be inadequate to prevent their exposure to the intense concentrations of mercury vapors created during the pipe cutting. According to workers interviewed there were large amounts of mercury left in the pipes that were cut -- often there was so much mercury that they would have to notch the top of the pipes and heat the mercury to the boiling point to volatilize it before the pipes could be heated enough to cut. According to other worker accounts the superheated mercury would actually rise to the top of the cell house and condense falling back to the floor in fine droplets of mercury "rain". There it would form puddles of mercury in the cell house floor. After exposure to these conditions, the construction workers reported that they were refused use of the Olin facility showers before leaving the work site.

Thirty of the construction workers exposed to the mercury have been diagnosed as having mercury poisoning. Many of these are currently undergoing chelation therapy at the Vanderbilt Medical Center. The Tennessee Occupational Safety and Health Administration has done extensive monitoring for mercury as well as doing surveys of the construction workers that were involved. Since the worker exposure was very intense and the workers did not remove contaminated clothing or cleanup prior to leaving the site, the Emergency Response and Control Section requested that the Environmental Services Division screen for mercury in several of residences of the construction workers to assure that their families were not being exposed to hazardous concentrations of mercury.

OBJECTIVE

The objective of this study was to determine if there are hazardous levels of mercury in the air in the residences of the construction workers that are currently undergoing treatment for mercury poisoning. In addition an attempt was made to determine if there are concentrated hot spots of mercury contamination in the home that could result in pathways of exposure other than air.

STUDY AREA

The residences of the construction workers involved were located in four counties around the Olin plant. The locations of the six houses that ESD monitored are shown in Table 3.

SAMPLING PLAN

At each house an eight-hour sample was taken using Jerome dosimeter tubes and an Alpha battery powered sampling pump. In addition to the eight-hour samples taken with the dosimeter tubes, several instantaneous readings were taking using the Jerome model 511 Hg analyzer. The purpose of the instantaneous readings was to determine if there were any hot spots of mercury contamination in the house while the purpose of the eight-hour samples was to determine if there were in concentrations of mercury in the ambient air inside the house that could be hazardous.

The eight-hour dosimeter samples were taken in the locations shown in Table 2. The locations were chosen to be representive of the breathing air in the house, with the living rooms being the most common site for sample collection. The dosimeter tubes were connected to the battery powered Alpha sampling pumps and adjusted to a flow rate of approximately 20 cc/min. Sampling continued for eight hours. At the end of the sampling period the dosimeter tubes were retrieved and attached to a power supply, an internal heater inside the dosimeter tube was activated which liberated any trapped mercury and the liberated mercury was analyzed by the Jerome model 511 Hg analyzer.

The instantaneous readings were performed by allowing the Jerome model 511 Hg analyzer to run through it's 2 minute sampling cycle while drawing an air sample with an internal pump from a 3 foot section of Tygon tubing. Samples were taken at the locations shown in Table 1.

ANALYTICAL PLAN AND QUALITY ASSURANCE

All samples were either analyzed on-site (instantaneous readings) or in a van (dosimeter samples) that has been modified to serve as a mobile laboratory. Instrument and flowrate calibrations were performed in the mobile laboratory as well.

The Jerome model 511 Hg analyzer was calibrated prior to analysis and after the second day of analysis. All battery powered Alpha sample pumps were calibrated against an NBS tracable flowmeter before and after sampling. The Jerome model 511's internal pump was calibrated against an NBS tracable flowmeter before and after the sampling.

RESULTS

All results are shown in Tables 1 and 2. Readings showed low concentrations at most locations throughout the homes. However, some hot spots (such as washing machines, work boots and vehicle interiors) were located.

The 2-minute instanteous readings were generally less than 10ug/M3. However, several values ranged from 10.2 ug/M3(inside work truck) to 53.8 ug/M3 (over one washing machine tub). Other elevated values were observed in a plastic bag containing work boots (19.9 ug/M3) as well as over two other washing machines (11.3 and 19.4 ug/M3). The NIOSH 10-hour time weighted average mercury exposure limit is 50 ug/M3.

The 8-hour composite air samples collected from the general living areas of the six residences were low ranging from 1.0 ug/M3 to 5.0 ug/M3.

TABLE 1

Olin Chemical
Mercury Study
Screening of Workers Homes

U.S. EPA

Hg Readings
2 minute samples
with Jerome Model 511 Analyzer

Residence	Date	Time	Location	HG Vapor µg/M³
(b)(6) Personal	11/2/88	1:15 pm	living room	mdl
		1:20 pm	kitchen table	mdl
		1:25 pm	kitchen sink	mdl
		1:30 pm	over washing machine tub (lid open)1/	2.7
		1:35 pm	work boots in plastic bag	19.9
		1:39 pm	inside truck on driver's side	10.2
(b)(6) Personal	11/2/88	3:56 pm	1' over living room carpet	mdl
		4:00 pm	kitchen counter next to sink	4.3
		4:03 pm	over kitchen sink2/	5.9
		4:06 pm	over washing machine tub (lid open)1/	11.3
		4:09 pm	bathroom sink in master bedroom	7.0
		4:13 pm	tool room	4.3
		4:16 pm	over open tool box	5.4
		4:20 pm	over open tool bucket	11.8
		4:29 pm	inside Ford Bronco on drivers side	8.1
(b)(6) Personal	11/3/88	10:23 am	living room chair	mdl
		10:25 am	living room chair under cushion	mdl
		10:31 am	1" over carpet bathroom master BR	2.2
		10:34 am	over shower drain in bathroom	2.2
		10:37 am	6" over bed in master bedroom	mdl
		10:40 am	vacuum cleaner hose	2.2
		10:46 am	inside truck above seat—driver's side	3.2
		10:49 am	inside truck above floor—driver's side	3.8
		10:52 am	over washing machine tub (lid open)1/	19.4
		10:55 am	inside spare work boots	mdl

1/ capped bottle of bleach nearby
2/ capped bottle of cleanser nearby

mdl = 2µg/M³

NIOSH Exposure Limit = 50µg/M³ 10 hr. time weighted avg.

TABLE 1 (cont)

Olin Chemical
Mercury Study
Screening of Workers Homes

U.S. EPA

Hg Readings
2 minute samples
with Jerome Model 511 Analyzer

Residence	Date	Time	Location	HG Vapor $\mu g/M^3$
(b)(6) Personal Privacy	11/3/88	12:51 pm	living room above chair	5.4
		12:54 pm	inside workboots	5.8
		12:56 pm	outside workboots	3.2
		1:01 pm	6" over Mr. Bradley's bed	4.3
		1:04 pm	counter between kitchen and den	5.9
		1:09 pm	6" over Mr.Gourley's bed	5.4
		1:12 pm	over washing machine tub (lid open) 1/	mdl
		1:15 pm	inside dirty clothes closet	mdl
(b)(6) Personal Privacy	11/3/88	3:03 pm	6" over Allan Queen's bed	5.9
		3:05 pm	6" over carper in bedroom	2.2
		3:09 pm	over coffee table in living room	2.2
		3:12 pm	over couch w/cushion pulled out	2.2
		3:19 pm	over washing machine tub (lid open) 1/	53.8
		3:26 pm	washing machine lint filter	4.3

1/ capped bottle of bleach nearby

mdl= $2 \mu g/M^3$

NIOSH Exposure Limit = $50 \mu g/M^3$ 10 hr. time weighted avg.

TABLE 2

Olin Chemical
Mercury Study
Screening of Workers Homes

Hg Readings
8 Hr. Sample With Dosimeter Tubes
Analyzed With Jerome Model 511 Analyzer

Residence	Date	Time	Location	HG Vapor $\mu g/M^3$
(b)(6) Personal Privacy [redacted]	11/2/88	1:11 pm – 6:15 pm	living room	1.6
	11/2/88	3:47 pm – 11:47 pm	living room/kitchen	5.0
	11/2/88	9:29 am – 4:03 pm	living room	2.4
	11/2/88	10:27 am – 5:26 pm	living room	2.1
	11/2/88	1:07 pm – 9:07 pm	den/kitchen	1.0
	11/2/88	3:22 pm – 11:22 pm	bedroom	1.1

mdl= 0.5 $\mu g/M^3$

NOTE: MDL is lower with dosimeter tube samples because of larger air volume samples

APPENDIX III

Health Assessment for

2 8 0024

OLIN CHEMICAL COMPANY

CHARLESTON, TENNESSEE

NOVEMBER 14, 1988

Tox

H

PRELIMINARY HEALTH ASSESSMENT
OLIN CHEMICAL COMPANY
CHARLESTON, TENNESSEE
NOVEMBER 14, 1988

Prepared by:
Office of Health Assessment
Agency for Toxic Substances and Disease Registry

Background

On August 22, 1988, employees of the Yeargin Construction Company were contracted by the Olin Chemical Company to replace some pipes and fittings in cell house 812 at the Olin Plant. In the cell house, the workers reported seeing pools of mercury 3-4 inches deep on the floor. The available protective clothing consisted of disposable Tyvek suits, rubber half-boots, and cartridge respirators. The workers used oxyacetylene torches to cut pipes in the room. Some of the pipes reportedly contained standing mercury, and it was necessary for the workers to use their torches to volatilize the mercury before the pipes could be heated enough to cut. According to worker accounts, the volatilized mercury would condense at the ceiling of the room and fall back to the floor as mercury "rain". Workers reported that their gloves, clothes, and boots became soaked with mercury. The work period lasted from 7:30 a.m. to 12 midnight, so some workers may have been exposed for as long as 16.5 hours. At the end of the workday, the workers reported that they were denied access to the Olin facility showers.

The workers returned home in their personal vehicles. On the way home, some workers became ill and reported vomiting. Since the workers' clothes and tools were visibly contaminated with mercury, it is likely that mercury contamination of their vehicles and residences resulted. One worker reported pouring pooled mercury from his boots down the sink drain at home. Washing machines at the workers' homes were used to launder work clothes.

As a result of the extensive exposure to mercury in the Olin Facility, many of the workers developed symptoms of mercury toxicity and sought medical treatment. Three of the men reported episodes of violent behavior which were not typical of their normal behavior patterns. In some of the men, urine samples collected 1 month after the initial exposure still contained an elevated concentration of mercury. An undetermined number of affected workers were hospitalized and have received chelation therapy from Dr. Andrew Heath at the Vanderbilt University Medical Center.

This Preliminary Health Assessment is based on information obtained from (1) U.S. Environmental Protection Agency - Region IV (EPA) and ATSDR regional staff, and (2) EPA memorandum: Air monitoring results from Mercury screening of Olin construction workers' homes, Danny France to Bob Jourdan, November 8, 1988.

Environmental Contamination and Physical Hazards

On November 2-4, 1988, the Environmental Services Division of the EPA, Region IV, screened 6 homes of affected workers for possible mercury contamination. A Jerome Model 511 Analyzer, which provides an instantaneous readout of air mercury concentrations, was used to locate mercury hot spots.

In living areas in the homes, air mercury concentrations ranged from below detection (2 ug/m^3) to 5.9 ug/m^3. However, hot spots were detected in the homes in locations such as over the washing machine tub (54 ug/m^3) and over the sink (7.0 ug/m^3). In addition, elevated air mercury concentrations were detected inside workers trucks (8.1 - 10 ug/m^3).

Air samples were also collected from living quarters over an 8-hour period using a dosimeter collection tube and pump. Using this technique, air mercury concentrations of 1.0-5.0 ug/m^3 were detected.

This air monitoring was conducted more than 2 months after the mercury contamination had occurred. During this time, it is likely that some of the mercury in the homes had been removed by cleaning, vacuuming, volatilization and dissipation in the air, etc. Therefore, it is likely that the initial air mercury concentrations were higher than current levels, but no information on the original air concentrations is available.

Officials from the Tennessee Occupational and Safety and Health Administration have reportedly surveyed the workers and monitored for mercury in their homes, but their findings were not available for review.

Potential Environmental and Exposure Pathways

Metallic mercury volatilizes to a vapor at ambient temperatures. Mercury vapor readily diffuses across the alveolar membranes of the lungs, and it has been estimated that 80 percent of inhaled metallic mercury is absorbed by humans. To a lesser extent, mercury may also be absorbed through dermal contact with elemental mercury. After absorption, mercury is slowly eliminated from the body by urinary and fecal excretion. The biological half-life of mercury vapor appears to be in the range of 35-90 days.

The recent detection of mercury in air from the homes of affected workers demonstrates that mercury contamination of the homes is still present. During cold weather, the doors and windows of homes are usually kept closed to prevent the loss of heat. Under these conditions, the exchange of air between indoors and outdoors would be reduced, and this could result in an increase in indoor air concentrations of mercury.

Demographics

It was estimated that 24-27 workers were exposed to mercury contamination at the Olin Facility during the pipe cutting episode. These workers live within a 40-45-mile radius of the Olin Plant. Although little demographic information is available, it is known that some of the workers are married and have children at home. Some of the workers reportedly live in trailers.

Evaluation and Discussion

The most consistent and pronounced effects of inhalation exposure to mercury vapor are on the central nervous system. A spectrum of neurological and psychological effects may develop which can include depression, irritability, exaggerated response to stimulation (erethism), excessive shyness, insomnia, emotional instability, etc. The classic neurological manifestation of mercury toxicity is a tremor of the muscles that perform fine-motor functions, such as the fingers, eyelids, and lips. Nonspecific symptoms such as anorexia, weight loss, and muscular weakness may also occur.

Many of the exposed workers experienced these classic symptoms of mercury toxicity and have undergone chelation therapy to accelerate the elimination of mercury from their bodies. These individuals should avoid any further exposure to mercury, since this would contribute to their body store of mercury and prolong their recuperation.

Other family members in the affected homes are also being exposed to mercury contamination. Since elemental mercury can cross the placenta, a fetus may also be exposed to mercury from its mother's blood.

In the 6 homes tested, the 8-hour air concentrations of mercury ranged from 1.0-5.0 ug/m^3. The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) have recommended that workplace concentrations of mercury should not exceed 50 ug/m^3 over an 8-hour period. However, it is not appropriate to apply this value to a residential situation since: (1) occupational exposure applies to an 8-hour day and a 5-day week; in the home, exposures may occur 24 hours a day and 7 days a week, and (2) the occupational exposure recommendations apply only to healthy workers; this exposure may not be protective of sensitive segments of the population such as the young, the old, or the ill. Therefore, acceptable exposures to mercury in the home should be set well below the ACGIH and NIOSH values.

In the 1986 Superfund Public Health Evaluation Manual, the EPA recommended that chronic exposure to mercury in air should not exceed a concentration of 0.18 ug/m^3. This value was derived by correcting the recommended occupational exposure value for an assumed continuous exposure and incorporating a 100-fold uncertainty factor.

Conclusions and Recommendations

Based on the available information, this situation is considered to be of public health concern because of the risk to human health resulting from the inhalation of mercury vapors in the private residences of the exposed workers. Prolonged exposure to the maximum concentration of mercury detected in indoor air samples would pose a significant health risk for previously exposed workers and other family members.

Therefore, the following recommendations are made in order to protect the public health.

(1) All of the homes and vehicles of workers who were involved in the described incident should be evaluated for mercury contamination using an acceptable sampling protocol, analytical methodology, and appropriate quality analysis/quality control procedures.

(2) All of the homes identified to date, as well as other homes which demonstrate mercury contamination, should be immediately cleaned to remove residual mercury. Special attention should be given to washing machines, sink drains, showers, rugs, and other areas where elemental mercury may have lodged. Following cleanup, air mercury concentrations in the homes should not exceed the detection limit (0.5 ug/m^3). Vehicles should also be checked and cleaned, if warranted.

(3) Family members residing in mercury-contaminated homes should be tested for mercury exposure by urine or blood analyses. Such testing is particularly indicated for individuals with symptoms of mercury toxicity. Appropriate medical evaluation and monitoring should be initiated for those individuals identified with abnormal results.

(4) The incident has been brought to the attention of Federal NIOSH officials, and we suggest involvement of Occupational Safety and Health Administration at an appropriate time.

Data obtained from future environmental testing and biomonitoring should be forwarded to ATSDR for evaluation. This information will form the basis for further assessment by ATSDR as warranted by public health issues.

Break: 2.8
Other:

2 8 0038

OHA - please follow-up.

BJ

TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Environment
Environmental Epidemiology
100 Ninth Avenue, North
Nashville, Tennessee 37219-5405

December 2, 1988

Dr. Barry L. Johnson
Associate Administrator
Agency for Toxic Substance & Disease Registry
1600 Clifton Road, N.E.
Atlanta, GA 30333

Dear Dr. Johnson:

On August 22, 1988, during a scheduled maintenance operation at the Olin Chemical Co. plant in Charleston, Tennessee, approximately 50 workers of the Yeargin Construction Company were exposed to inorganic mercury vapor. As a result of this exposure at least 5 workers were hospitalized and many others are being treated. At the conclusion of this project, workers returned to their homes and mercury on their clothes and equipment contaminated their houses and vehicles.

On October 24, 1988, as a result of a call from one of the workers, EPA designated the contamination incidence serious enough to activate the Regional Response Team. Although the Environmental Epidemiology unit of the Tennessee Department of Health and Environment was not involved in this decision, we feel the problem is serious enough that it deserved evaluation to determine (1) the extent of contamination and (2) if exposed family members are in need of medical intervention.

We, therefore, are requesting your staff's assistance in conducting a survey of the homes of the workers and an evaluation of appropriate biological specimens.

Your staff can co-ordinate with Dr. Robert Taylor in my office. He can be reached at (615) 741-5683.

Sincerely,

Patrick A. Turri
Director, Environmental Epidemiology

PAT/C8028337/L&M

cc: Jeff Lybarger, M.D., ATSDR
Jim Kopotic, OSC, EPA
Sharlinda Turner, M.D., SERO
Richard T. Light, M.D., Chief Medical Officer, TDHE
Terry Cothran, ESC, TDHE
Wayne Scharber, Director of Environment, TDHE

2 8 0039

Site:
Break: 2.8
Other:

JAN 17 1989

Mr. Patrick A. Turri
Director, Environmental Epidemiology
Tennessee Department of Health and Environment
100 Ninth Avenue, North
Nashville, Tennessee 37129-5405

Dear Mr. Turri:

This is in response to your request for technical assistance to conduct a survey of homes of workers exposed to mercury during a scheduled maintenance operation at the Olin Chemical Company plant in Charleston, Tennessee, and an evaluation of the appropriate biological specimens.

As you are aware, December 7-10, a team of ATSDR and State staff conducted this survey. A total of 46 households of 51 identified participated in the survey for a total of 117 urine specimens.

These urine specimens are now being analyzed by the Center for Environmental Health and Injury Control, Division of Environmental Health Laboratory Sciences (DEHLS). The specimens are complete and have gone to the DEHLS statisticians to assess QA/QC. We expect to have the results shortly. The questionnaires have been sent to be keypunched which should be completed by next week.

We thank you for the opportunity to work with you. If we can be of any further assistance, please do not hesitate to contact us.

Sincerely yours,

Mark M. Bashor

Mark M. Bashor, Ph.D.
Director
Office of Health Assessment

cc:
C. Pietrosewicz

2 8 0040

Site: ____
Break: 2.8
Other: ____

March 20, 1989

EIS Medical Officer, MS, HETAB, DSHEFS
Industrial Hygienist, NIOSH, Atlanta Region

Activities Report on HETA 89-043
Olin Chemical Company, Charleston, Tennessee

Wendy Kaye, Ph.D.
Senior Epidemiologist, ATSDR, OHA/EMB
Through: Director, DSHEFS_____ __
Chief, HETAB_____ __
Chief, MS_____ __
Group Leader, MS_____ __

At the request of the Environmental Protection Agency (EPA) and the Agency for Toxic Substances and Disease Registry (ATSDR), the National Institute for Occupational Safety and Health (NIOSH) assisted these agencies in investigating a reported incident involving worker exposures to elemental mercury at a chlor-alkali facility owned and operated by the Olin Chemical Corporation, in Charleston, Tennessee. The purpose of NIOSH's investigation was to identify those workers who, on August 22, 1988, had undertaken demolition work in the Olin's E-812 Cell Building. NIOSH investigators were also asked to determine if further medical assessment was needed for these workers.

BACKGROUND

The incident investigated involved the Yeargin Construction Company, a contractor hired by Olin to remove a "dilute caustic" piping system from the cell building. According to Yeargin employees who worked on this job, elemental mercury poured from the pipes onto the floor when they cut the lines open with their oxygen/acetylene torches. During this 16-hour demolition job, workers wore only disposable coveralls and rubber overshoes. Cartridge respirators were available, but their use was not enforced. Although the Olin plant had showers and clothes washers for their own cell building employees, contractors were required to provide their own facilities. Because Yeargin had no such facilities, workers could not clean-up or remove their contaminated clothing before leaving the plant to go home.

Through the National Response Center, a Yeargin worker notified the Environmental Protection Agency (EPA), Region IV on October 24, 1988. This worker was concerned that his home and family may have been contaminated by mercury he brought home on his clothes from the demolition job. He also reported that 27 other Yeargin workers had been exposed and that he and several others were undergoing treatment for mercury poisoning at the Vanderbilt University Medical Center.

ACTIONS TAKEN

On November 21, 1988, NIOSH investigators attended a meeting in Nashville, Tennessee to obtain background information. The meeting was called by the Tennessee Emergency Management Agency (TEMA) to brief state officials about the August 22, 1988 incident, and to discuss the outcome of a Regional Response Team (RRT) meeting held in Atlanta, Georgia at the request of EPA Region IV, on November 18, 1988. Attending the November 21st meeting were representatives of NIOSH, TEMA, Tennessee Department of Health and Environment, and both state and federal Occupational Safety and Health Administration (OSHA) representatives.

Following the Nashville meeting, the NIOSH medical investigators met with Dr. Andrew Heath, a clinical toxicologist from Vanderbilt University. Dr. Heath had become involved because over 3 months following the exposure incident, Dr. William Proffit, a Cleveland, Tennessee physician had referred to Dr. Heath 25 workers whose urine mercury levels in 24-hour samples were above 20 micrograms per liter (ug/L). Dr. Proffit had been hired by Yeargin Construction to provide urine mercury screening on all 53 employees who had worked in the E-812 Cell Building on August 22nd.

On November 28-29, 1988, NIOSH investigators conducted an initial medical and industrial hygiene survey at the chlor-alkali facility. We met with officials from TEMA, TDHE, TOSHA, EPA, ATSDR, Olin Chemical, and Yeargin Construction management to detail the events of August 22, 1988. During our survey, we identified 53 employees from Yeargin Construction who were involved in the demolition work in the "E-812 Cell." A list of these employees' names was given to EPA and ATSDR for these agencies to survey the homes of these employees for elemental mercury contamination. The employees' names were also matched with medical records obtained from Dr. Proffit. We also reviewed Dr. Proffit's medical records to verify that each employee had been screened for mercury exposure.

FINDINGS

1. The medical records we reviewed showed that all 53 Yeargin employees had submitted 24-hour urine mercury specimens for analysis during the 3 months following the incident. We also confirmed that 25 Yeargin workers had been referred to Dr. Heath for follow-up evaluation.

2. After the 25 referred workers underwent medical examinations and neuropsychologic testing at Vanderbilt, Dr. Heath began chelation therapy for 21 of the 25 workers. Dr. Heath reported that the 24-hour urine mercury levels for these workers ranged from 25 to 200 ug/L prior to chelation. According to Dr. Heath, the workers receiving chelation treatments have shown minimal clinical improvement, primarily on repeat neuropsychological testing and neurological exams.

3. Neither Olin nor Yeargin monitored personal exposures to mercury vapor on the day of the incident. However, each morning an Olin "Voltage Control Technician" is required to monitor the cell building with a Bacharach mercury vapor sniffer (detection limit 0.01 mg/m^3). On the morning of August 22, 1988, 12 readings were taken on the 2nd floor of the E-812 Cell building (cell level) and 10 readings were taken in the basement (below the cells where the piping system was being removed). Readings obtained on the 2nd floor reportedly ranged from 0.018 to 0.09 milligrams per cubic meter (mg/m^3). Readings from the basement were from 0.005 to 0.04 mg/m^3. Area monitoring was reportedly done again later that day at noon, but sniffer readings were not recorded. Reportedly all readings were below the OSHA Permissible Exposure Limit (PEL) of 0.1 mg/m^3. It was not clear what, if any, work Yeargin crews were doing at the time the 12:00 P.M. readings were taken. Mercury vapor concentrations were not continuously monitored and the job site was not "posted" as a mercury exposure hazard. However, according to instructions listed on Olin's "line break" permits, respiratory protection is required when lines are opened. Reportedly, Yeargin workers first started the job wearing rubber rain suits, but because of the heat they quickly switched to Tyvek disposable coveralls. Apparently, because the building was not posted, respirator use was not enforced.

   On the following day, after the demolition work was completed, the routine monitoring check found one location in the basement of the E-812 Cell building, near a stack of cut-up pipes, showing a mercury vapor concentration of 0.25 mg/m^3. Mercury vapor levels on the 2nd floor ranged from 0.024 to 0.3 mg/m^3. Because some locations checked were above the PEL, the building was "posted." When an area is posted, respiratory protection and disposable protective clothing are required.

4. In an attempt to quantify the amount of mercury spilled on August 22, 1988, NIOSH requested from Olin, mercury monitoring data for the cell building effluent recorded from August 21-24, 1988. The data represented waste waters collected from the plant's cell room operations, and rain water from various containments and fill operations during the period. During this period, 11 batches of waste water were treated. Mercury levels in these 11 batches, before treatment, ranged from 6 to 53 parts per million (ppm). There was no relative increase in mercury contamination in the untreated plant waste water following the August 22 incident. Because Olin does not monitor mercury contamination in waste streams for each cell building, we were unable to verify if waste water from the E-812 Cell Building was more contaminated with mercury than usual as a result of the header pipe removal job done by Yeargin Construction workers on August 22.

5. A surveillance program for Olin's Cell Building workers has been functioning at the plant since 1964. Olin has established a urine mercury "action level" of 25 ug/L. Workers who show mercury

concentrations above this level are required to use respirators until their levels come down. If their levels exceed 35 ug/L, they are temporarily removed from mercury exposure areas. Workers in the program are required to wear protective coveralls and overshoes, use cartridge-type respirators, submit to urine monitoring, and undergo after-shift decontamination, which includes the use of a special locker room, on-site washing of work clothes, and showers. It is also Olin policy to put any Olin worker into the surveillance program any time that worker is involved in a job having the potential for mercury exposure, if that job requires more than 4 hours to complete.

6. Although Olin requires any contractor working on-site to comply with all company health and safety regulations, contractor employees are required to implement their own surveillance program, and provide their own decontamination facilities. The Yeargin Construction Company apparently had neither.

7. It appears that all Yeargin employees exposed to elemental mercury in the "E-812 cell building" on August 22, 1988, have received adequate medical assessment. Follow-up evaluations, per Dr. Heath, were performed on those employees exceeding the upper limit of the general population range of urine mercury excretion of 20 ug/L in a 24-hour sample. Estimates of mercury concentrations in blood and urine related to time-weighted average air concentrations, and their association with the earliest health effects in adults following long-term exposure (one year or more) to elemental mercury vapor have been compiled by a World Health Organization (WHO) study group. The WHO found nonspecific symptoms associated with urine mercury levels of 150 ug/L, whereas tremor was associated with urine mercury levels of 300 to 600 ug/L. Based on these findings, the study group recommends removal of workers with mercury levels that exceed 100 ug/L in a 24-hour urine sample. Although the WHO urine mercury values are based on long-term exposures, it would seem that the screening value of 20 ug/L used by Dr. Heath should be more than adequate to identify those employees likely to be symptomatic from their short-term exposure of August 22, 1988, particularly since the few studies done of the biological half-lives for elemental mercury or mercury vapor found the range of values to be from 35 to 90 days (according to the third edition of Casarett and Doull's Toxicology).

RECOMMENDATIONS

1. Olin should insist that all contractors working on site have effective medical surveillance and environmental monitoring programs for contractor employees. If smaller contractors, with limited resources or expertise, lack these programs, agreements should be written in the contracts to permit contractor employees access to Olin's medical and industrial hygiene services.

2. Decontamination facilities for use by contractors should be furnished by Olin. All workers, including contractor employees, who have been potentially exposed to mercury, should be required to shower and change clothes before leaving the plant. Work clothes should be washed on-site before being returned to contractor employees.

3. All contractor employees should be trained and fit-tested with appropriate respiratory protection equipment before being allowed to work in areas of the plant where potential mercury, chlorine, or other hazardous exposures may exist. Contractors' respiratory protection programs should be reviewed and approved by Olin's industrial hygienist before the contractor personnel are allowed to work in potentially hazardous environments.

4. All contractor personnel assigned to work in potentially hazardous environments should receive adequate chemical hazards training as required by the OSHA hazard communications standard.

5. Non-routine tasks involving potential mercury exposure risks should be monitored more frequently with appropriate direct reading instruments throughout the duration of the tasks. If monitoring is not possible, respiratory protection should be mandatory.

6. Olin should "post" job sites and require the use of respirators and appropriate protective clothing where 8-hour time-weighted average exposures could exceed 0.05 mg/m^3. This lower limit will be required by OSHA starting September 1, 1989.

Richard R. Hammel, M.D.

Stanley A. Salisbury, C.I.H.

cc:
Jim Kopotic, OSC, EPA Region IV
J.P. Newman, Mgr., Product Quality & Env. Control, Olin Chemicals
L.D. Petty, Jr., Manager of Maintenance Services, Yeargin Inc.
Cynthia Wolfe, ARA, Tech Support, OSHA Region IV
Donald E. Witt, DOSH, Tennessee Dept of Labor
Pat Turre, Env. Epi., TN DHE
bcc:
Robert Rinsky
Mitch Singal
Dawn Tharr
Paul Roper
Anne Fidler
Rich Hammel
Stan Salisbury
Atlanta Region File, HETA 89-043
HETAB File - HETA 89-043
Med. Sec. File - HETA 89-043
Hammel Reading File
RHAMMEL:v11:Rm.310:HAMILTON:Cinti:OH:Doc.#19750/Doc #19830

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV, ATHENS, GEORGIA

Site:
Break: 2.8
Other:

MEMORANDUM

2 8 0045

DATE: APR 26 1989

SUBJECT: Inspection Reports for Olin Corporation, Charleston, Tennessee

FROM: M. D. Lair, Chief
Hazardous Waste Section
Environmental Compliance Branch
Environmental Services Division

TO: Jim Kopotic, OSC
Emergency Response and Control Section
Superfund Branch
Waste Management Division

The NPDES, RCRA and Air Compliance inspection reports for the subject facility are attached.

Attachments (3)

cc: Finger/Patton

2 8 0046

DEC 28 1988

Mr. Barry Sulkin
Division of Water Quality Control
Tennessee Department of Health
and Environment
150 Ninth Avenue North
Nashville, TN 37203

Re: Compliance Evaluation Inspection
Olin Corporation - TN0002461

Dear Mr. Sulkin:

Enclosed is a copy of the Compliance Evaluation Inspection report for the above named facility. Since no distribution has been made by this office, please forward copies to the permittee and appropriate state personnel.

If you have any questions or comments please contact Roger DeShane or me at 404/347-3973.

Sincerely yours,

ORIGINAL SIGNED BY

Douglas K. Lankford, Chief
SC/TN Unit
Compliance Section
Facilities Performance Branch
Water Management Division

Enclosure

DESHANE:ehb:3973:12/19/88

DEC 28 1988

NPDES Compliance Evaluation Inspection of Olin Inc., Charleston, Tennessee

Life Scientist
SC/TN Unit, Compliance Section

Jim Kapotic
On Scene Coordinator RPT

THRU: Douglas K. Lankford, Chief
SC/TN Unit

In response to a request by the Regional Response Team an NPDES Compliance Evaluation Inspection was conducted at the Olin Corporation's Charleston, Tennessee facility on 12-13-88. A copy of the inspection report is attached. This memo is not intended to be part of the inspection report but is designed to deal with specific problems arising from the reported 8-22-88 incident.

The members of Olin's environmental staff, including J.P. Newman the manager of product quality and environmental control, were very cooperative and willing to allow the inspection team access to any areas where process waste water might originate. Since we were most interested in mercury, our inspection focused on the origination point of any mercury contamination, treatment of mercury bearing waste water, and discharge of the treated waste water.

We examined the ground floor of the mercury cell building which was approximately 10,000 square feet in area. The floor was of concrete with drainage channels leading to four sumps which were approximately 3 feet by 6 feet and 4 feet deep. The ceiling was not continuous, but rather a pipe gallery with openings and gratings leading to the next floor. We saw no evidence of mercury but were told that any stray mercury was washed into the sumps. This wash water then ran through a mercury recovery unit before going to the treatment facility. The treatment facility consisted of two 50,000 gallon fiberglass tanks, sodium hydrosulfate dosing tanks and filter press. In addition to mercury bearing waste water, other waste streams from the manufacture of BHT and chlorine were also directed to this facility. Treatment is on a batch basis with each tank treated as it becomes full. An analysis for mercury is performed both before and after treatment. Sludge from the precipitation reaction is dewatered in a filter press and disposed of in a covered hazardous waste disposal area on the 1200 acre site. Treated waste water is then routed to a series of three ponds with a detention of two weeks. The pH of this waste water is very low (pH 2-3) so the remainder of treatment consists of pH adjustment with caustic. No elemental mercury was observed at any stage of treatment.

There are three other permitted discharges from this site. All are either storm drains or non contact cooling water. Water from roof drains is collected and treated in carbon filters. All three storm/cooling water outfalls are sampled for mercury with flow proportional composite samples taken daily.

Our examination of the laboratory log in which each day's sampling and analytical results were recorded did not indicate any mercury excursions. The period during and after the 8-22-88 incident was examined carefully but no significantly different mercury concentrations were recorded. The NPDES computer work up sheets showed no mercury excursions for the past year and the daily log kept on the mercury treatment facility showed no increases in mercury concentrations to the treatment facility especially during the critical period following 8-22-88.

In summary, the NPDES Compliance Evaluation Inspection showed nothing that would indicate mercury entered waters of the United States in excess of the limits allowed by the permit. However, as is the case with most chemical plants, it is difficult to identify and trace all waste water routes. In addition, it would be difficult to detect manipulation of sampling and analytic records. However, nothing we saw indicated that Olin had acted incorrectly.

Bradley Nicolajsen

NICOLAJSEN:ehb:12/19/88

2 8 0049

United States Environmental Protection Agency
Washington, D. C. 20460

SEPA

NPDES Compliance Inspection Report

Form Approved
OMB No. 2040-0003
Approval Expires 7-31-85

Section A: National Data System Coding

Transaction Code	NPDES	yr/mo/day	Inspection Type	Inspector	Fac Type
5	TN0002461	88 12 13	C	J	2

Remarks

Reserved	Facility Evaluation Rating	BI	QA	Reserved	
67 69	70	71	72	73 74	75 80

Section B: Facility Data

Name and Location of Facility Inspected	Entry Time ☐ AM ☐ PM	Permit Effective Date
Olin Corporation P.O. Box 248 Charleston, TN 37310	Exit Time/Date	Permit Expiration Date

Name(s) of On-Site Representative(s)	Title(s)	Phone No(s)
J.P. Newman	Manager, Product Quality & Env. Control	615/336-4234

Name, Address of Responsible Official	Title	
M.S. Davenport	Plant Manager	
	Phone No.	Contacted ☐ Yes ☒ No

Section C: Areas Evaluated During Inspection

(S = Satisfactory, M = Marginal, U = Unsatisfactory, N = Not Evaluated)

S	Permit	S	Flow Measurement	N	Pretreatment	S	Operations & Maintenance
S	Records/Reports	S	Laboratory	N	Compliance Schedules	S	Sludge Disposal
S	Facility Site Review	S	Effluent/Receiving Waters	S	Self-Monitoring Program		Other:

Section D: Summary of Findings/Comments (Attach additional sheets if necessary)

SEE ATTACHED SHEET

Name(s) and Signature(s) of Inspector(s)	Agency/Office/Telephone	Date
Roger DeShane	USEPA ATLANTA 404 347 3973	12/23/88
Bradley R. Nicolaysen	USEPA, REGION IV, ATLANTA (404) 347-3973	12-22/88
Signature of Reviewer	Agency/Office	Date
[signature]		12/27/88

Regulatory Office Use Only

Action Taken	Date	Compliance Status
		☐ Noncompliance ☐ Compliance

EPA Form 3560-3 (Rev. 3-85) Previous editions are obsolete.

Summary:

On Tuesday December 13, 1988 a joint Compliance Evaluation Inspection (CEI) was made at the Olin Corporation in Charleston, NPDES TN0002461. This plant discharges to the Hiwassee River near miles 16 to 17 and was issued a modified permit on November 22, 1988. The tour of the site was conducted by J.P. Newman manager. Other people who attended our meeting were: C. Richard Rowe, Environmental Supervisor, Jack O'Grady, Quality Control, Dan Bennewitz, Lab Supervisor, Frank McMillan and Mike Stakely, lab personnel, Joe Hartman TNDWPC, Rod Davis, Bradley Nicolajsen, and Roger DeShane, U.S. EPA.

Permit (Satisfactory) - A current permit was available and correctly identified the four discharges and receiving waters, Hiwassee River, mile 16 to 17.

Records/Reports (Satisfactory) - All required information was available, complete, and current.

Facility Site Review (Satisfactory) - The site was well maintained and safety precautions and measures are obvious around the plant.

Flow Measurement (Satisfactory) - Flow measurements are by Parshall Flume and Isco 1700 flow meter. Instrumentation is calibrated frequently.

Laboratory (Satisfactory) - Approved analytical procedures are used and calibration of instruments is satisfactory.

Effluent/Receiving Water (Satisfactory) - Effluent at the time of inspection was clear and clean.

Pretreatment (Not applicable) - No pretreatment is required.

Compliance Schedule (Not applicable) - Olin Corporation is not under any compliance schedule at the present time.

Self-Monitoring Program (Satisfactory) - The samplers were set up in the correct locations and reports are submitted on time. However, while we were inspecting outfall 001 the sampler probe was above the water level and was drawing air. This was corrected during our inspection. The water level in the well should be watched a little closer.

Operations and Maintenance (Satisfactory) - The plant is well operated and maintained.

Sludge Disposal (Satisfactory) - Waste material is trucked to an approved on site land fill.

DESHANE:ehb:3973:12/19/88

RD

2 8 0051

JAN 2 6 1989

4WD-RCRA

RECEIVED
MAR 2 8 89
HAZARDOUS WASTE SECTION

Mr. Phil Newman
Olin Corporation
Post Office Box 428
Charleston, Tennessee 37310

Dear Mr. Newman:

Enclosed please find the report for the RCRA inspection performed on December 13, 1988. On the day of the inspection no violations of the applicable regulations were observed. If you have any questions, do not hesitate to contact Mr. Javier E. Garcia at 404/347-7603. We appreciate the courtesy shown during the visit.

Sincerely yours,

Allan E. Antley, Chief
Waste Compliance Section
RCRA Branch

cc: Tom Tiesler, TDHE
Guy Moose, TDHE

Garcia/am/lexitron/disk #4/Doc. 35

GARCIA BRITTAIN ANTLEY

RCRA INSPECTION REPORT

1) Inspector and Author of Report

Javier E. Garcia
Environmental Engineer

2) Facility Information

Olin Corporation - TND003337292
Post Office Box 428
Charleston, Tennessee 37310

3) Responsible Official

Phil Newman, Manager
Product Quality and Environmental Control

4) Inspection Participants

Phil Newman - Olin
Jack W. O'Grady - Olin
Dan Bennewitz - Olin
Javier E. Garcia - USEPA, RCRA Branch
Clinton Boyd Jr. -USEPA, Air Branch
Kevin I. Taylor -USEPA, Air Branch
William R. Davis -USEPA, ESD

5) Date and Time of Inspection

December 13, 1988
9:00 a.m.

6) Purpose of Survey

Multi-media inspection to assess Olin's compliance with environmental regulations. Specifically, this inspection was performed to evaluate an incident which occurred on August 22, 1988, at the mercury cell located in building [illegible].

7) Facility Description

Olin is engaged in the manufacture of calcium monochlorite ([illegible]) using a chemical reaction, the manufacture of sodium hydrosulfite (reducione[illegible]) using mercury electrolytic cell technology and chemical reaction process, and the manufacture of chlorine and sodium hydroxide using the mercury electrolytic cell process.

The hazardous wastes generated are: brine mud sludge from the mercury cell process (K071), wastewater treatment filter cake (K106), o-dichlorobenzene (U070), methanol mixture containing pyridine (D001), trichloromonofluoromethane (U121), toluene, xylene mixture (F003/F005), various lab wastes, glues and paints (D001), mercury contaminated wastewater and spent solvents (F001) and (F002).

The D001, U121, U070, F001, F002 and lab pack wastes are stored in 55-gallon drums prior to shipment off-site for disposal. A landfill unit is used for the storage of the mercury contaminated waste (U071), (U121) (K106) and (D009).

8) Findings

A conditional delisting for the brine mud sludge (U071) was granted by the State of Tennessee. Every batch is analyzed for TP mercury, if the content is greater than 0.09 mg/l, it is handled as a hazardous waste and disposed in the on-site hazardous waste landfill.

On August 22, 1988, Yeargin Company was contracted to remove a section of the header from the mercury cell located in the building 822. This header is used to transfer caustic soda from the mercury cell process to a unit where mercury is recovered from caustic soda. The caustic soda is reused to adjust pH on different processes. According to Olin's representative the pipes were hosed at the same time they were cut. This rinse water was collected in sumps which are connected to the wastewater treatment plant. As standard procedure any visible mercury collected in the sump is removed for reuse. All the removed pipes were disposed of in the on-site hazardous waste landfill. The on-site wastewater treatment plant receives discharges from the sumps and all mercury contaminated wastewater. From the treatment of this wastewater, K106 wastewater treatment sludge from the mercury cell process in chlorine production, is generated. The sludge is collected in dumpsters and disposed of in the on-site hazardous waste landfill. This landfill is double-lined with a leachate collection system and is covered with a positive pressurized dome of Tedlar coated nylon. The groundwater monitoring system consists of 10 monitoring wells and 14 piezometers.

The State of Tennessee has granted a "Variance from the Classification as a Solid Waste" for the solvent used to clean painting equipment. The spent solvent is recovered with a small distillation unit. Because of the variance, the spent solvent is not subject to any RCRA regulation even before it is recovered.

On the inspection day a total of 10 drums were observed in the storage area. All of the containers were closed, labelled and appeared in good condition.

9) Conclusion

During this inspection no violation of the RCRA regulations was observed. However, the "Land Disposal Restrictions" were not evaluated because an inspection, by EPA Headquarters, was scheduled for that same week. The company was informed that EPA is evaluating the variance for the spent solvent granted by the state. In view of the explanation given by Olin's personnel, it appears that no RCRA violation occurred during the August 22, 1988 incident.

2 8 0054

10) **Signed**

Jaime Garcia
Inspector

11) Concurrence

Doyle T. Brittain, Chief
West Compliance Unit

Concurrence

Allan E. Antley, Chief
Waste Compliance Section

Garcia/ljd/disk Garcia

Garcia Brittain Antley

1/24/89

1/24/89

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

DATE: JAN 20 1989

SUBJECT: EPA Inspection of Olin Chemical Corporation Located In Charleston, Tennessee

FROM: Clinton Boyd, Jr., Environmental Engineer
Northern Compliance Section

TO: Jewell Grubbs, Chief
Northern Compliance Section

SUMMARY

On December 13, 1988, EPA inspectors, Clinton Boyd and Kevin Taylor conducted a compliance inspection at Olin Chemical Corporation located in Charleston, Tennessee. The inspection revealed that Olin Chemical's cell 812 was in violation of EPA's applicable housekeeping practices, as specified in regulation 40 CFR 61.53(c)(4), referencing Appendix A of "Review of National Emission Standards for Mercury," EPA-450/3-84-014a, December 1984, which states that "all floors should be regularly inspected, cleaned, and, to the extent practical, chemically decontaminated".

At the time of inspection, the floors of the cell room were badly cracked and mercury droplets were found in several of the cracks, around the base of support poles and in the depressions of the floor.

There was also a question of whether the mercury droplets found in the cell room would cause a violation of the National Emission Standard for Hazardous Air Pollutants (NESHAP), specifically 40 CFR 61.52(a), which limits mercury emissions to 2300 grams per 24 hour period. At present, there are no applicable control techniques available to reduce mercury emissions within the cell room except for ventilation, which helps to dilute the concentration. The only way to minimize the amount of mercury vapor entering the cell room atmosphere is by utilizing effective housekeeping and maintenance procedures which are not being done in the case of the Olin cell room.

Further file review revealed violations of the recordkeeping requirements as specified in regulation 40 CFR 61.55(d)(1), which states that "stationary sources determining cell room emissions in accordance with §61.53(c)(4) shall maintain daily records of all leaks or spills of mercury, the records shall indicate the amount, location, time, and date the leaks or spills occurred, identify the cause of the leak or spill, state the immediate steps taken to prevent future occurences, and provide the time and date on which corrective steps were taken".

RECOMMENDED ACTION

It is recommended that the U.S. EPA issue a NOV to Olin Chemical Corporation for violations of the applicable housekeeping practices.

BACKGROUND

The facility experienced a mercury release on August 22, 1988, in which several contractor personnel were exposed. A referral from the EPA Region IV to the Tennessee Department of Health Environment, Air Pollution Control Division (TDAPC) resulted in the TDAPC's referral of this matter to the Tennessee Department of Labor. EPA Region IV conducted a subsequent investigative inspection on December 13, 1988.

Attachment
Field Inspection Report

FIELD INSPECTION REPORT

I. INTRODUCTION

A. Facility:	Olin Chemical Corporation
B. Location:	P.O. Box 248 Charleston, Tennessee 37310
C. Date of Inspection:	December 13 1988
D. Type of Inspection:	Investigative
E. Investigators:	Clinton Boyd, Jr. - U.S. EPA Kevin Taylor - U.S. EPA R.E. Stewart - Production Mgr. Phil Newman Plant Manager Jack O'Grady - Assoc. Env. Affairs Specialist Rick Hall - Chlor-alkali Super Dan Bennewitz - Env. Engr.
G. Purpose:	To conduct an onsite investigative inspection of Olin Chemical in order to determine its compliance status with regard to the applicable federal NESHAP regulations.

II. EXECUTIVE SUMMARY

A. Facility Compliance Status:

The inspection on December 13, 1988, revealed that Olin Corporation's cell room 812 was operating in violation of EPA's housekeeping practices, specified in the NESHAP regulation [40 CFR 61.53(c)(4)], referencing the Appendix A of "Review of National Emission Standards for Mercury," EPA-450/3-84-014a, December 1984, which states that "All floors should be maintained in good condition, free of cracking and spalling and should be regularly inspected, cleaned, and to the extent practical, chemically decontaminated." Olin may also be in violation of NESHAP regulation 40 CFR 61.52(a) which limits total mercury emissions to 2300 gm/day based on an assumed cell room emission rate of 1300 gm/day. This assumed cell room emission rate is based solely upon the facility's ability to adhere to the EPA's housekeeping practices stated previously.

At the time of inspection, the floors of the cell room were found to be in violation of these housekeeping practices by possessing several cracks and depressions in which mercury entrapments were found.

Further file review revealed, in regard to a mercury release in cell room 812 on August 22, 1988, violations of the recordkeeping requirements as specified in regulation 40 CFR 61.55(d)(1), which states that "stationary sources determining cell room emissions in accordance with §61.53(c)(4) shall maintain daily records of all leaks or spills of mercury. The records shall indicate the amount, location, time, and date the leaks or spills occurred, identify the cause of the leak or spill, state the immediate steps taken to minimize mercury emissions and steps taken to prevent future occurences, and provide the time and date on which corrective steps were taken."

B. Point Compliance Status:

1. Complying Points:

   No other points except cell room 812 were inspected during the 12/13/88, inspection.

2. Violating Points:

   Cell Room 812.

3. Photographs:

   Photographs were taken inside cell room 812.

III. FINDINGS

A. Process Description:

Olin is a chlor-alkali processing facility which produces liquid chlorine, sodium hypochloride, sodium hydroxide and hydrochloric acid for industrial sale.

The process begins with the shipment and storage of sodium chloride and brine to the facility. These two components are combined to form a salt solution which is sent to the electrolytic cells for electrolysis. Within the electrolytic cells, mercury is used as a flowing cathode, running concurrently with the salt solution. A current is applied between the mercury cathode and the anode to form chlorine gas and alkali amalgam. The amalgam is separated from the brine in a discharge end-box and enters the decomposer where the amalgam becomes the anode to a short-circuited graphite cathode. Hydrogen gas and sodium hydroxide are formed in the decomposer (denuder), and the amalgam is converted back to mercury and purified by distillation in mercury retorts. The mercury is then recycled to the inlet end-box, where it reenters the electrolyzer. The major emissions of mercury from this process occur with the hydrogen gas stream, the end-box ventilation system, and the cell room ventilation air.

After leaving the decomposer, the hydrogen gas stream contains substantial mercury and water vapor. This stream is cooled in two stages and the mercury that condenses from this operation and any remaining mercury vapors are removed using the Pura Siv absorption system which guarantees an outlet mercury concentration of 0.05 mg/m^3.

The cell room is ventilated in order to cool and also to dilute the concentration of mercury for the safety of workers.

The chlorine gas from the electrolyzer is sent to a compressor where it is converted to liquid chlorine. The remaining chloride gas and noncondensables mixture is sent to a waste gas scrubber where it is bubbled through caustic soda to form a sodium chlorate, sodium chloride solution. The solution is marketed to customers.

In the reductone process, sodium from the cells is combined with caustic and sulfur dioxide in a nitrogen atmosphere to form reductone (sodium hydrosulfite). This reaction takes place in an enclosed reactor and any sulfur dioxide escaping from the reactor is not detectable by the nose (less than 5 ppm).

B. Conclusions:

The cell room 812 of Olin's facility is in violation of EPA's housekeeping procedures for chlor-alkali plants as specified in the NESHAP regulation [40 CFR 61.53(c)(4)] referencing Appendix A of "Review of National Emission Standards for Mercury," EPA-450/3-84-014a, December 1984. Cracks, crevices and holes were found throughout both floors of the cell room, exhibiting a clear violation of said regulation. Mercury droplets were found in several of the cracks in the floor, around the base of support poles and in the depressions of the floor.

If good housekeeping practices were employed, as specified in 40 CFR 61.53(c)(4), an emission rate of 1300 g/day of mercury could be assumed for the cell room. However, cracks, crevices and entrapments were seen throughout the cell room placing Olin in violation of said regulations. It is, therefore, impossible to calculate the total required mercury emission rate using an assumed value and possible noncompliance of the required mercury emission rate as set out in NESHAP regulation 40 CFR 61.52(a), which limits total mercury emissions to 2300 gm/day based on an assumed cell room emission rate of 1300 g/day. Therefore, it can only be concluded that Olin is in violation of this regulation also.

IV. BACKGROUND

A. History of Enforcement Actions

There have been no enforcement actions implemented by the EPA for any previous violations.

B. Previous State Actions

According to the state files, this facility is currently in compliance.

Prepared by: Victor Bryant Date: 1/24/89

Reviewed by: G. Gubler Date: 1/23/89

Site:
Break: 2.8
Other: FINAL

MINUTES
Site-Specific Regional Response Team Meeting
November 18, 1988

Re: Olin Chlor-alkali Facility
Charleston, Tennessee
Mercury Incident

The meeting was called to order at 9:05 a.m. by Mr. Robert Jourdan, EPA Co-Chair of the Federal Region IV Regional Response Team. He introduced the On-Scene Coordinator for the incident, Jim Kopotic along with the alternate OSC, Shane Hitchcock. He stated that another alternate OSC would be named later. He then established out some ground rules in order to keep the meeting running smoothly. He then introduced the voting members of the RRT that were present, including Terry Cothron, Emergency Services Coordinator for the State of Tennessee. This was followed by all other attendees introducing themselves. A list of attendees is attached.

Jim Kopotic, OSC for the incident, gave a chronology of events, beginning with the phone call received on October 24, 1988, from a Yeargin Construction Company employee who contacted the National Response Center stating he was concerned about his wife's health due to his exposure to mercury. A copy of the chronology of events is attached and was given to all attendees at the meeting. Mr. Kopotic stated that based on the information he had received from the individual, he contacted Mr. Chuck Pietrosewicz, Environmental Toxicologist with ATSDR, who then contacted Dr. McClanahan, Environmental Toxicologist with ATSDR. After discussion and planning, air monitoring surveys were conducted by EPA's Environmental Services Division on six homes of Yeargan employees involved in the incident. Concurrently, Messrs. Kopotic and Pietrosewicz interviewed available workers and their family members.

During the interviews, more information on the incident and subsequent actions was obtained. According to the workers, approximately 300 tons of mercury was released. It was also stated that Olin discharges mercury contaminated waste into the Hiawassee River. Additionally, trenches were dug and a silvery sludge flowed into the trenches. Olin and Yeargin later came to homes of affected employees, did some monitoring, and also confiscating some car seat covers, boots and vacuum cleaners. The Tennessee OSHA office also did an investigation of the incident but no information was obtained from them prior to the meeting.

Possible health affects were then discussed. Dr. Ken Orloff, ATSDR, stated that a preliminary health assessment had been made. He stated that NIOSH had been contacted and would assign medical investigators to work with TOSHA and Olin to ensure all exposed workers were medically evaluated. He said that they would look at the cell room and would investigate any secondary contamination that could have been carried home by the workers. The preliminary health assessment recommended that all homes be checked, and that residual mercury be removed. It also recommended urine and/or blood screening. He also stated that the report was being passed on to ATSDR's Epidemiology and Medicine Branch for their review. They have the option to go out and look at the people involved by doing a pilot study or symptom study, etc. The effect of exposures to mercury poisoning was discussed. Symptoms include irritability, irresponsibility, deviation from normal behavior and intent tremors and other central nervous system disorders.

It was stated that the levels of mercury found in the homes for the most part were below the 8 hour average exposure limit of 50 ug/m^3, but this limit does not apply to homes as people are normally in there homes for more than 8 hours a day. Dr. McClanahan spoke with Dr. Heath, of the Regional Middle Tennessee Toxicology Center. Dr. Heath had chelated 5 of the employees when he spoke with Dr. McClanahan. He was preparing to start several others, and is probably up to 15 or 20 now. This is a process of treatment to accelerate removal of the mercury from the body. It involves overnight stays in the hospital and side effects do occur. It was stated that removal of mercury from the body reverses the effects of the exposure.

It was stated that if mercury is still in the homes, the workers could be adding to their exposure levels. Additionally, this would complicate the therapy if they are still being exposed. When questioned about the need to evacuate, Dr. Orloff responded that if there were overt symptoms in the case of family members or if you measured mercury levels at the OSHA occupational exposure levels, relocation would be necessary.

The detection limit of 0.5 ug/m^3 suggested in the Preliminary Health Assessment was discussed. It was stated that this was given as a detection level and not a clean up level. Below 0.5 ug/m^3, you would expect any health effects from exposure.

Mr. Cothron stated that beyond the priority of determining what workers were exposed during the incident and preparing the appropriate testing and surveying of them for that incident, and then maybe going into chronic exposure in the past and currently, maybe the residential concern should be the next priority, if not equal. He further stated that before you get to the question of evacuating, the homes should be surveyed again to include not only air sampling but also swipe sampling. Further, once an appropriate level is determined, do you ventilate, evacuate and write if off, or evacuate for some shorter period of time, clean up, then bring the residents back.

Dr. Orloff reiterated that if there was any secondary exposure that resulted in any of the symptoms mention, that would be evidence that the workers and their families should be relocated from their homes. He also stated that he was not aware any symptoms of family members being reported.

Establishing levels and the readings taken in the homes was discussed. It appeared that the more scrupulous the families were with cleaning, the lower the readings were. Some workers removed their work clothes prior to entering there homes and some homes were cleaner than others.

Mr. Kopotic stated that he would like for NIOSH, ATSDR and ESD to get together and evaluate available information; talk to Dr. Heath; Yeargin and Olin; come of with a list of how many workers were receiving medical attention; obtain available medical records; and, look at what type of sampling we need to do inside the homes, and determine whether or not we need to evacuate. He stated he would also like to see inspections conducted at the facility under Title III, RCRA Air, Water and OSHA.

Paul Rienermann, of EPA's Air Compliance staff, stated that there had obviously been a violation of the NESHAPS regulations issued under the Clean Air Act. There is a 17 step maintenance procedure of chlor-alkali facilities. Number 16 states that a portable tank should be used to collect any mercury spills during maintenance procedures. It was also stated that the State would have issued an air emissions permit that would contain mercury limits to the facility. Mr. Rienermann stated that he would contact the State and possible set up a joint inspection of the facility.

Respiratory protection was discussed. Ms. Wolfe, OSHA, stated that it would generally be the responsibility of both companies to ensure that proper personnel protection was utilized. It depends on the contract between the two parties, but Yeargin should be responsible for protection of it's employees.

Contact with Olin was then discussed. Mr. Kopotic stated that he thought the situation was very sensitive and did not want to make any contact with Olin prior to convening the RRT. Mr. Cothron then stated that most of the information that we have now would be considered anecdotal, unless we have documentation that it would raining on the workers. He stated that the typical response from companies put in this position would be to document something, whether it was the appropriate personnel doing something or not, or to do some type of post incident documentation. We should not go into it thinking that the Company is not doing anything.

Mr. Hitchcock stated that we should keep in mind that EPA's jurisdiction is outside of the plant. Mr. Cothran stated that it looks like an occupational exposure/health issue. Mr. Hudson stated that EPA does have the authority to do an audit inside the plant under CERCLA 104 if there has been a release of if there is a threat of a release. Can make recommendations and if there were an immediate threat, could probably do an order outlining actions to be taken.

Mr. Jourdan then summarized the proceedings. Everyone agree that the highest priority was the exposure to the workers. The second priority would be the exposure to the workers' families and their homes. The third would be exposure to the public and possibly equally the exposure to the environment.

How to deal with exposure of the workers was then discussed. It was stated that NIOSH in Cincinnati had been contacted and would be able to come and do an inspection as soon as possible. They must be contacted by either the employer, the union, or three of the workers prior to becoming involved. A hazard evaluation request form must be signed and sent to NIOSH in Cincinnati. If signed by three workers, can be done confidentially. The State can also request NIOSH involvement as technical assistance. Mr. Jourdan stated that he felt that under the RRT, the OSC could request that NIOSH respond to the incident. The area is fairly rural and Olin is a major employer; some felt it unlikely that three employees would come forward and request the investigation.

Right of enter into the plant was then discussed. Mr. Newton, EPA attorney, stated that under the emergency provisions of CERCLA, EPA could take other federal agencies into a plant as technical assistance. However, if you are doing an investigation after the fact, where there was no emergency situation, you may have a problem. Use of 104 authorities was discussed. If was stated that it would be permissible to use 104 authorities as long as it was a legitimate use. It was stated that under technical assistance, NIOSH has right of enter for research purposes. It was stated that the strongest authority was OSHA's. TOSHA has the inspection and enforcement authority. The RRT will need to know what their findings are and what contact they have had with Olin.

The NIOSH inspection procedure was outlined. NIOSH would identify all affected and potentially affected workers. There would then probably be a questionnaire survey soliciting symptoms. Subjective assessment of exposures, biological monitoring for mercury levels. Depending on assessment, may do other monitoring. Would get medical records to obtain levels from earlier testing. Could also go in and assess monitoring that Olin did. It would take NIOSH a few weeks to get the study set up before they could get started.

Mr. Jourdan suggested that NIOSH, ATSDR, TEMA and OSHA get together and come up with a suggested plan on how we should respond, what information we needed to get, what action we need to take. The need for the TOSHA report and involvement was discussed. Ms. Wolfe of OSHA stated that she would contact TOSHA. It might be difficult to get a copy of the file during an ongoing investigation. Mr. Cothran and Ms. Wolfe agree to contact OSHA to see if he could get a copy of the report.

After a brief break, discussion continued centered around the workers' homes and families. After some discussion, it was decided that environmental sampling of the homes would occur first. Based on the screening, identify homes with contamination present. Then go into those homes and test the residents for secondary exposure. It was noted that you would have to do some testing of the residents, as they already know that mercury is there. NIOSH will do medical monitoring on the workers, if warranted, based on review of medical records. It was recommended that all worker homes be surveyed in the Preliminary Health Assessment.

Mr. Jourdan summarized the decisions reached. NIOSH will do the medical monitoring on the workers. Either ATSDR or the State Health Department will do the medical monitoring on any others that are found to need to be tested. It was then decided that ESD and ERT would do the sampling of the homes of the workers that were exposed. Mr. Kopotic agreed with the RRT's suggested response actions.

Mr. Hitchcock then posed a question concerning the levels used. He asked that if you test a home and get a low level, how do you know that there aren't higher levels in the residents's bodies, as it has been some time since the initial exposure. Reference was made to the statement made earlier saying that lower levels were found in the cleaner homes. Mr. Hudson stated that the people may have gotten more exposed getting it cleaned. It was then stated that the cleaning process didn't make there exposure any greater. There long-term exposure was probably diminished as there immediate exposure was somewhat elevated. We don't really know whether or not a three month exposure at .1 ug/m^3 would show elevated levels of mercury in the urine. A sample background might be necessary. Mr. Cothran stated that he did not want the sampling to be limited to air, there still may be mercury in other areas in the homes. It was suggested that the health department on Vermont be contacted as they had an episode a few years ago involving mercury where homes had to be sampled. Mr. Yatabe relayed information on Dr. Fred Ziegler, with ERM, who was responsible for establishing concentrations for action in the Vermont episode.

Mr. Jourdan again summarized the decisions reached. ESD, ERT doing air monitoring, to include swipe sampling. TEMA will also be involved. NIOSH will be doing medical monitoring on the workers, as well as pulling together background information. ATSDR/CDC will be the fall back on monitoring the residents that have been exposed if the Tennessee Health Department is not able to do so. Presumably, the study will be designed to include background levels from surrounding communities as well as appropriate screening for women and children.

Developing the action level was discussed. Mr. Hitchcock mentioned the EPA risk assessment people, could maybe assist in determining the level. The 0.5 ug/m^3 was discussed. Dr. Orloff stated that it was based on detection levels, and that below that level there would not be any significant health concerns below this levels. Dr. Orloff stated that it does not mean that everyone above that level are affected. The level could be higher, a safety factor was used to set it below the 8 hour exposure limit.

Mr. Cothran asked if there were other compounds that we should be concerning with, that the workers were exposed to during this incident. It was stated that there was brine and caustic solutions, that would cause superficial burns on the skin but would not enter the body. There may have also been some chlorine gas present. It was stated that 0.5 ug/m^3 is the lowest reading that can be obtained using dosimeter tubes.; the lowest reading that can be obtaining using instantaneous Jerome sampling analyzer is 2 ug/m^3. It was concluded that the dosimeter tubes would be best to use. It was also suggested that while analysis was being done, that checking for hot spots be done as well. Additional information would be obtained on the Jerome method.

The personnel in the plant were discussed. Mr. Kopotic stated that based on his information, Olin employees were not exposed during the incident. It was presumed that NIOSH would check into Olin worker exposure while conducting their investigation.

After a break for lunch, it was decided to set the action level at 0.5 ug/m^3. This would be the level that would trigger a response. As additional information is obtained, recommendations can be made to the OSC to change the level. Any RRT members that wish to be consulted prior to changing the action level will be contacted.

Relocation concerns were discussed. Based on discussions with ATSDR and immediate relocation is not warranted. A temporary relocation may be necessary while the trailers are being cleaned. Mr. Paul Fay, FEMA, stated that if cleanup would only be for 1 day, FEMA would not be able to provide any assistance through Superfund. If three or more days, FEMA would need advance time to go to meet with people involved. FEMA would need at least seven days preparation time to do a temporary relocation. TEMA would be involved in the process. FEMA can also provide rental assistance for short-term relocations to hotels. FEMA will need a list of the people, the number of people per family, and an interagency agreement or a site specific agreement prior to contacting TEMA. Mr. Fay suggested that he be provided with a number and estimate of what we think we will have and then give locations, family names, number in family, number of days to be relocated, etc. The State would actually run the operation, FEMA would provide a letter of credit up front; the State would draw down the money as needed. If TEMA does not elect to do the relocation, FEMA will have to send someone there to find a resource. Once it is determined that relocations will occur, notify FEMA as soon as possible.

It was decided that Mr. Hudson would coordinate with Mr. Fay and Mr. Fay is to coordinate with TEMA. Mr. Hudson is to make sure that we have interagency agreement in place to effect the temporary location if needed. Mr. Hudson is to get the list from NIOSH and get it to Mr. Fay.

Mr. Jourdan then discussed issuing a 106 order to Olin and/or Yeargin to do the cleanup of the homes. Presuming that they would accept the responsibility to perform the cleanup, we would have an OSC to oversee the cleanup operation. If they choose not to, we would do the cleanup using our ERCS contractor. Mr. Kopotic stated that some of the workers have stated that they would not let anyone from Olin into there homes.

Mr. Jourdan concluded that a 106 unilateral order will be issued within the next week. If we run into a situation with a party that won't let Olin come into their home, we can try to negotiate a consent order with Olin to go in and do the work. On the six families that we have data on, could issue order next week, specifying five day response time. Presumably for the six families, cleanup would take place in about two weeks. Order would be issued saying cleanup the six plus any others that are found to be over the limit during our investigation.

Sampling of homes is planned to begin the week of November 28, 1988. Hope to do four homes per day. Looking into having two teams working, utilizing ERT.

Mr. Jourdan suggested that any calls from the press by referred to Mr. Hagan Thompson, Public Affairs Officer at EPA. Mr. Cothron stated that this would be difficult in light of the work that TOSHA is doing. Mr. Cothron said that they will probably get out in front with a pro-active statement to the press. Mr. Kopotic said that he was shown a newspaper article about the TOSHA investigation while he was in the area.

Mr. Jourdan then discussed the environmental issues. Mr. Brad Nicolajsen, EPA NPDES compliance officer, said that the State had conducted a Compliance Sampling Inspection at the facility on September 27, 29 and 30, 1988. They also sampled in the river for possible toxics. He also pointed out that radioactive tracers are used in the process. He stated that there haven't been any enforcement actions against the facility. Results are not back from the inspection, may not show effects of incident as this was a month later. It was suggested that fish tissue sampling be done to determine chronic exposure.

Mr. Kopotic stated that he would like to have a multi-media inspection, to include water, air, RCRA and Title III. Mr. Cothran questioned the need for a multi-media inspection at this time. He suggested that this was not a priority and could be done at a later date. Mr. Kopotic suggested sampling of the river. In conclusion, a task force was appointed to come up with a long-term monitoring program. Also, a couple of people go in as a normal spill inspection. Mr. Jourdan suggested that an OSC and someone from TEMA go in and do the spill inspection. It was recommended that someone from Air go also as they know a lot about these kinds of facilities. The multi-media task force would include TEMA, ground-water, air, Title III, RCRA.

The normal spill response will take place the week of November 28. Will include Mr. Kopotic, Javier Garcia (RCRA), Paul Rienermann (Air), Terry Cothran (TEMA). The long range multi media inspection will take place in January. Will be chaired by Doug Lair, to include Henry Hudson, Jim Kopotic, Terry Cothran, John Lindsey, NOAA.

All actions , including any enforcement actions, are to be coordinated with the OSC.

RRT will reconvene in approximately two weeks.

Site:
Break: 2.8
Other:

2 8 0061

Memorandum

May 4, 1989

Senior Toxicologist, Health Sciences Branch, OHA and
Epidemiologist, Epidemiology and Medicine Branch, OHA

Mercury Contamination of Indoor Air in Private Residences;
Charleston Tennessee

Chuck Pietrosewicz
Public Health Advisor
EPA Region IV

ATSDR has reviewed the available analytical data on indoor air mercury concentrations in private homes of Olin contract workers and the urine mercury concentrations in the family members.

Urine samples were collected by ATSDR personnel from non-occupationally exposed family members during early December 1988. The samples were subsequently analyzed for mercury by the Center for Environmental Health and Injury Control. The mercury concentrations in the urine samples from 114 family members ranged from 0.2-26.9 ug/L (mean - 5.1, standard deviation - 4.4).

In a population with no known exposure to mercury, urine concentrations of mercury range from 1-25 ug/L (1). Therefore, the family members tested for this study were within the non-exposed range except for a single individual (26.9 ug/L) who slightly exceeded this range.

In an occupational setting, urine mercury concentrations in excess of 50 ug/L are an indication of exposure, and concentrations in excess of 100 ug/L represent a warning level for potential health effects. Urine mercury concentrations in excess of 200 ug/L correspond to a hazardous exposure level (2).

As judged by these criteria, the urine mercury concentrations in the individuals tested do not give evidence of excess mercury exposure and would not be expected to represent a significant health concern.

Indoor air monitoring for mercury was conducted at the workers' homes by EPA Region IV Environmental Services Division during November and December 1988. Analyses of 12-hour air samples from 45 homes revealed the indoor air mercury concentrations to range from less than 0.1ug/m^3 to 5.0 ug/m^3.

Mercury decontamination cleaning was subsequently conducted in 25 homes where air mercury concentrations exceeded 0.5 ug/m^3. Following cleanup efforts, the indoor air concentrations of mercury ranged from non-detectable to 0.58 ug/m^3.

The post-cleanup concentrations of mercury that were detected in indoor air would not be expected to pose a significant health risk. This conclusion is reinforced by the absence of significantly elevated urine concentrations of mercury in the samples collected during December 1988.

It is therefore concluded that further cleaning of the workers' homes is not indicated at this time.

Kenneth G. Orloff, Ph.D.

Bonnie S. Richter, Ph.D.

References

1. L.J. Goldwater and W. Stopford, Mercury, in: Environment and Man, J. Lenihan and W.W. Fletcher, ed. Volume 6, Academic Press, New York, pages 38-63, 1977.

2. Albert L. Knight, Mercury and its Compounds, in: Occupational Medicine - Principles and Practices, 2nd ed., Carl Zenz, Year Book Medical Publishers, Chicago, pages 590-596, 1988.

2 8 0063

Site:
Break: 2.8
Other:

CLEANING OF CERTAIN YEARGIN EMPLOYEE'S HOMES

Prepared By:

ERM-Southeast, Inc.
PO Box 881
Brentwood, TN 37024-0881

August 17, 1989

Other Office Locations:

Marietta, Georgia
Charlotte, North Carolina
Mobile, Alabama

TABLE OF CONTENTS

Section No.	Title	Page No.
1.0	BACKGROUND	1
1.1	August 22, 1988 Incident	1
1.2	Federal Regulatory Involvement	1
1.3	Administrative Order	2
2.0	CLEANING PROCEDURES	2
2.1	Cleaning Crew Selection and Training	2
2.2	Contacting of Homeowners	4
2.3	Cleaning Procedure	4
2.4	Car Cleaning	4
3.0	SAMPLING PROCEDURES	5
3.1	Initial Instantaneous Home Sampling	5
3.2	Clearance Instantaneous Home Survey	5
3.3	Dosimeter Sampling	5
3.3.1	Pump Calibration	5
3.3.2	Sampling System	7
4.0	SAMPLE ANALYTICAL PROCEDURES	7
4.1	Dosimeter Desorption and Concentration Calculation	7
4.2	Functional Test Procedure	8
4.3	Volume Calculation	9
4.4	Carbon Tube Analysis	9
5.0	ANALYTICAL RESULTS	9
5.1	Dosimeter and Carbon Tube Analytical Results	9
5.2	Home Clearance by EPA/ATSDR	9
5.3	Summary	14

LIST OF TABLES

Table No.	Title	Page No.
1-1	Homes Which the EPA Indicated Required Cleaning	3
2-1	Homeowners Whose Cars Were Tested for Mercury and Cleaned if Necessary	6
5-1	Analytical Results Subsequent to Cleaning of Certain Yeargin Employees' Homes	10

CLEANING OF CERTAIN YEARGIN EMPLOYEES' HOMES

1.0 BACKGROUND

1.1 AUGUST 22, 1988 INCIDENT

On August 22, 1988, employees of the Yeargin Construction Company were replacing header piping in cell house 812 at the Olin facility located in Charleston, Tennessee. During this construction, some employees claim to have been exposed to mercury. Subsequently, certain of these employees claim to have contaminated their homes and personal vehicles from mercury on their clothes and tools.

1.2 FEDERAL REGULATORY INVOLVEMENT

The United States Environmental Protection Agency (U.S. EPA) was contacted by one of the Yeargin employees. The U.S. EPA Region IV Environmental Services Division screened six houses for mercury in air levels during November 2-4, 1988. The Agency for Toxic Substances and Disease Registry (ATSDR) recommended an indoor level of mercury in air of 0.5 ug/m^3 or less. The EPA On-Scene Coordinator (OSC) indicated that this level was a guideline to be considered along with mercury in urine levels of family members of the employee.

Additional Yeargin employee homes were monitored by EPA from December 5 through December 13, 1988. During this period, a total of 45 homes of Yeargin employees were tested. ERM-Southeast, Inc. personnel accompanied the EPA to observe the monitoring. Several of the homeowners would not allow ERM personnel into their homes. Sampling included instantaneous surveying utilizing a Jerome 411 Mercury Monitor. Twelve hour sampling utilized dosimeters and personnel pumps which aspirated air at approximately 50 ml/min. The dosimeter tubes were desorbed and analyzed utilizing a Jerome 511 Mercury Monitor. Additionally, four Yeargin employees were not located by EPA and two employees

refused access to the EPA. EPA assigned an unique number to each homeowner. These numbers are utilized in this report instead of actual names. Two homes identified by EPA ID number 2 and 22 had two employees each in the same home.

In total, 25 of the homes sampled by the EPA exceeded the 0.5 ug/m^3 mercury level recommended by the ATSDR. The EPA declared that these homes required further testing and possible cleaning. Table 1-1 lists these homeowners by EPA ID number.

1.3 ADMINISTRATIVE ORDER

The U.S. EPA Administrative Order No. 88-34-C to Olin Corporation imposed a number of obligations, including the cleaning of certain homes "to levels deemed acceptable to EPA/ATSDR". Additionally, vehicles of Yeargin employees were to be tested and cleaned, if required. An attempt to contact Yeargin employees not located by the EPA during their survey was also required. Prior to any in-home activities taking place, the Order required that a suitable Work Plan and Safety Plan be developed and approved by the EPA. ERM-Southeast, Inc. was retained to conduct the above tasks. The testing and cleaning tasks required by the Order were conducted between March 20, 1989 through April 14, 1989.

2.0 CLEANING PROCEDURES

2.1 CLEANING CREW SELECTION AND TRAINING

Professional cleaning personnel were individually selected by ERM-Southeast, Inc. Each crew member received a physical prior to employment to determine his health status. A health and safety plan was prepared for this project and each crew member was thoroughly briefed concerning the aspects of this plan. Two houses not involved in the Administrative Order were cleaned by the two cleaning crews for training purposes prior to cleaning any of the Yeargin employees houses which were covered by the Order.

TABLE 1-1

HOMES WHICH THE EPA INDICATED REQUIRED CLEANING

EPA ID NUMBER
1
2
4
7
9
11
14
15
19
20
22
24
28
32
34
35
37
38
41
42
44
47
49
51
53

2.2 CONTACTING OF HOMEOWNERS

A certified letter was sent to each homeowner whose home required cleaning according to EPA requesting permission to clean his house. Contact with the owner via telephone then ensued by the Yeargin timekeeper in conjunction with ERM-Southeast personnel. A schedule for cleaning was determined and continually updated as the need arose.

2.3 CLEANING PROCEDURE

Carpets were either vacuumed utilizing a Nilfisk dry vacuum cleaner or were extracted via a professional quality wet vacuum extractor with an HgX solution or were both dry vacuumed followed by wet extraction. All wood furniture which exhibited mercury level was waxed with Pledge® or similar quality product. Upholstery cleaner was utilized to clean sofas, chairs, etc. which exhibited mercury levels via the monitor. Linoleum floors were washed with a solution of HgX followed by a rinse solution of water.

Vacuum cleaners were disassembled and cleaned as necessary using an HgX solution for the plastic parts; new bags were normally placed in the vacuum cleaner and the old bag disposed of properly. Washing machines which exhibited elevated mercury levels were cleaned by having HgX solution and/or powder placed in the wash cycle. This water was then contained and disposed of properly. The entire house was aired out during the cleaning process by raising windows, opening doors, and placement of box fans for air exchange. A receipt was given to the homeowner for any articles which could not be decontaminated. Any such article was sent back to Olin for proper disposal and subsequent replacement.

2.4 CAR CLEANING

Each homeowner was asked during the initial telephone conversation to have his car at home for testing and possible subsequent cleaning. Some homeowners did not comply with this request. Although not a part of the Order, Olin tested and cleaned any Yeargin employee's car who requested this service. This was accomplished by stationing a crew at the Olin facility in Charleston, Tennessee for one day to test and clean cars on employee request.

Table 2-1 presents a list of the homeowners listed under the Order whose cars were checked and cleaned, if necessary as well as certain homeowners who were not listed under the Order but who requested this service.

3.0 SAMPLING PROCEDURES

3.1 INITIAL INSTANTANEOUS HOME SAMPLING

Prior to commencement of any cleaning operations, a thorough survey of the home for mercury levels was conducted utilizing either a Jerome 411 or Jerome 431 Mercury Monitor. This survey was conducted in order to locate any area within the homes which may require more vigorous cleaning than normal and to ascertain the general in-home mercury air level present for determination of the required level of personal protection. Additionally, these homeowners' cars which were used for transportation home after the incident were tested and cleaned if any detectable mercury levels were found inside the car utilizing the Jerome 411 or Jerome 431 mercury monitor.

3.2 CLEARANCE INSTANTANEOUS HOME SURVEY

At the end of the cleaning operation and after the home had been closed to obtain equilibrium, the home was again surveyed using the mercury instantaneous Jerome monitor. This clearance survey was to ascertain that the home had been properly cleaned prior to the actual dosimeter sampling which would last for several hours.

3.3 DOSIMETER SAMPLING

3.3.1 Pump Calibration

Each pump which was utilized for dosimeter sampling was calibrated for a flow rate of approximately 50 ml/min. All pumps were SKC Model 224-PC7 constant flow pumps. The pumps were calibrated for low flow using an SKC pump calibrator with 50 ml and 100 ml graduations. The calibration is traceable back to a National Bureau of Standards primary

TABLE 2-1

HOMEOWNERS WHOSE CARS WERE TESTED
AND CLEANED IF NECESSARY

EPA ID NUMBER
1
2
4
5*
8*
9
11
15
17*
21*
24
26*
28
30
33*
35
36*
37
38
42
43*
44
49
50*
52*
53

* Indicates that a car belonging to a Yeargin employee, not one of the 25 employees listed under the Order, was tested and cleaned if necessary.

Note: Homeowner #19 rode in another employee's car the date of the incident.

standard. For dosimeter usage, the time for a soap bubble to traverse a volume of 50 ml was utilized. In certain instances, charcoal adsorption tubes were utilized in addition to dosimeters. For these cases, the flow rate of the pumps used for charcoal mercury sampling was set at approximately 100 ml/min. The 50 ml graduation on the glass calibrator was used for pumps utilized for charcoal sampling. The time required for the soap bubble to traverse the required distance (or volume, actually) was determined in at least duplicate runs and an average flow rate for the on-calibrator calculated. This procedure was also utilized after sampling for the off-calibration of each pump/dosimeter tube or pump/carbon tube utilized. An average of the on and off flow was utilized to ascertain the total volume of air sampled.

3.3.2 Sampling System

Jerome Goldfilm dosimeters were used in conjuction with the SKC Model 224-PC7 pump as the primary means of extended time sampling in the homes. The sampling systems were calibrated at approximately 50 ml/min and were normally set to sample over a 12-hour time span.

After cleaning, the homes were closed and allowed to come to a state of equilibrium before sampling began. Table 5-1 indicates sample duration for each home.

Some homes were sampled with carbon absorption tubes in conjuction with the Jerome dosimeters. Carbon absorption tubes were used as a means of in-house verification and cross checking of dosimeter results. These results are also included in Table 5-1.

4.0 SAMPLE ANALYTICAL PROCEDURES

4.1 DOSIMETER DESORPTION AND CONCENTRATION CALCULATION

At the end of the sampling period, each dosimeter was capped using the tygon tubing supplied by the manufacturer. The dosimeter was then transported back to the laboratory for analysis. The Jerome 431 was subjected to a film heat and zero adjustment prior to sample analysis. The desorption procedures are those enumerated in the Jerome 431 manual. The

electrical desorption cable was connected to the back of the Jerome 431 instrument; the cable was then hooked to the electrodes on the dosimeter. A zero air filter was then connected to the intake of the dosimeter tubing. The dosimeter was then desorbed until a zero reading wa obtained via the Jerome 431 monitor. All mercury meter response readings equal to or greater than 0.005 were summed according to the manufacturer's procedures. The following equation was used to calculate the mercury concentration in ug/m^3:

$$\frac{[MR \times 87.5]}{ml} = mg\ Hg/m^3$$

MR = meter response, sum of all responses equal to or greater than 0.005

87.5 = conversion factor (changes meter response to nanograms of Hg)

ml = total air volume in ml sampled by pumps

To change from mg Hg/m^3 to ug Hg/m^3, multiply by 1000

All desorption and subsequent calculations were observed by EPA personnel. Data were transmitted to EPA personnel as soon as it became available. All data calculations were subject to verification within two days after the desorption of each dosimeter.

4.2 FUNCTIONAL TEST PROCEDURE

A functional test verification was performed daily for each Jerome instrument utilized. This test only verifies that the instrument is functioning properly. Each test was performed according to procedures numerated within the appropriate manual. In summary, a droplet of mercury is stored in a thermos bottle which is airtight. The mercury volatiles to a constant concentration within the thermos depending upon the temperature (18°C to 22°C is the correct operating temperature range). A 1 cc sample of air within the thermos is taken by inserting a calibrated needle into the septum of the thermos bottle. This 1 cc of mercury in air is then injected into the septum assembly of the Jerome instrument. A concentration is then determined by the instrument. This procedure is then repeated again. Both concentration levels must be within the acceptable range (depending upon temperature) specified in the

manual. On one occasion, the Jerome 411 failed to meet the performance specification (low readings); it was subsequently sent back to the factory for repair and another instrument was obtained.

4.3 VOLUME CALCULATION

The air volume calculation section was covered under Section 3.3.3 Pump Calibration. In summary, an average of the on and off volume flow rates was obtained; the total flow during the sampling period was obtained by multiplying the average flow rate in ml/min. times the number of minutes of sampling. The total sampling volume in ml is thus obtained.

4.4 CARBON TUBE ANALYSIS

All carbon tubes were sent back to the Olin laboratory for analysis by the EPA accepted procedure of desorption and cold vapor atomic absorption.

5.0 ANALYTICAL RESULTS

5.1 DOSIMETER AND CARBON TUBE ANALYTICAL RESULTS

Table 5-1 presents the analytical results of the dosimeter and carbon tube analyses. The table presents the EPA I.D. number for the homeowner, the clean-up date, the analysis date, the sample duration period, and the analytical results.

5.2 HOME CLEARANCE BY EPA/ATSDR

All homes in which the ambient mercury levels were 0.5 ug/m^3 or less were approved immediately by the EPA OSC. For homes with ambient mercury levels slightly above 0.5 ug/m^3, the EPA OSC submitted these data to the ATSDR for review in conjunction with the homeowner's medical records. After review of these data the EPA in conjunction with ATSDR approved these homes. All home testing data are included in Table 5-1.

TABLE 5-1

ANALYTICAL RESULTS SUBSEQUENT TO CLEANING
OF CERTAIN YEARGIN EMPLOYEES' HOMES

EPA ID No.	EPA Sampling Results (ug/m³)	Clean-Up Date	Analysis Date	Sampling Duration (hrs.)	Dosimeter Analysis Results (ug/m³)
38	0.57	3/20/89	3/22/89	12	0.165
11	0.69	3/20/89	3/23/89	12	0.110
*	Not Sampled	4/10/89	4/4/89	12	0.204
				12	0.178
51	2.40	3/21/89	3/23/89	12	0.251
1	0.99	3/21/89	3/23/89	12	0.253
				12	0.228 (duplicate)
20	0.71	3/21/89	3/23/89	12	0.231
4	1.80	3/22/89	3/24/89	12	0.346
49	1.50	3/22/89	3/24/89	12	0.273
	1.40 (duplicate)			12	0.285 (duplicate)
24	0.61	3/23/89	3/26/89	12	0.172
2	1.00	3/23/89	3/26/89	12	0.792**
			3/27/89	12	0.405***
			3/28/89	12	0.529***
37	5.0	3/24/89	3/27/89	12	0.564
				12	0.575 (duplicate)
		3/29/89	3/31/89	12	0.588
		4/6/89	4/10/89	12	1.80
		4/12/89	4/12/89	8	1.55
		(no cleaning)		8	2.24
				8	0.24****
		4/13/89	4/13/89	6	0.875
				6	1.210
				6	0.36****

TABLE 5-1 (Continued)

ANALYTICAL RESULTS SUBSEQUENT TO CLEANING OF CERTAIN YEARGIN EMPLOYEES' HOMES

EPA ID No.	EPA Sampling Results (ug/m³)	Clean-Up Date	Analysis Date	Sampling Duration (hrs.)	Dosimeter Analysis Results (ug/m³)
		4/14/89	4/14/89	6	0.580
				6	0.584 (duplicate)
				6	0.260****
				6	0.260**** (duplicate)
				6	0.200****
34	1.10	3/24/89	3/26/89	12	0.368
22	1.10	3/27/89	3/29/89	12	0.101
19	≥3.00	3/27/89	3/29/89	12	Off Scale (≥2.44)
		4/4/89	4/6/89	12	Off Scale (≥2.44)
				6	14.0****
		4/12/89	4/12/89	8	0.288
				8	0.314 (duplicate)
				8	0.140****
15	≥3.00	3/28/89	3/30/89	12	0.466
				12	0.518
42	2.10	3/28/89	3/30/89	12	0.793
		3/30/89 (no cleaning)	3/31/89	12	0.853
				12	0.800 (duplicate)
		4/3/89	4/5/89	12	1.16
				12	1.21 (duplicate)
		4/7/89	4/10/89	12	0.641
		4/11/89	4/11/89	8	0.537
				8	0.554 (duplicate)
				8	0.170****
32	1.40	3/29/89	3/31/89	12	0.365

TABLE 5-1 (Continued)

ANALYTICAL RESULTS SUBSEQUENT TO CLEANING
OF CERTAIN YEARGIN EMPLOYEES' HOMES

EPA ID No.	EPA Sampling Results (ug/m³)	Clean-Up Date	Analysis Date	Sampling Duration (hrs.)	Dosimeter Analysis Results (ug/m³)
7	1.20	3/29/89	3/31/89	12	0.366
35	2.10	3/30/89	4/3/89	12	0.700
				12	0.657 (duplicate)
		4/5/89	4/7/89	12	0.531
53	1.00	3/31/89	4/3/89	12	0.313
				12	0.274 (duplicate)
9	1.60	3/31/89	4/3/89	12	0.622
				12	0.568 (duplicate)
		4/5/89	4/7/89	12	0.517
47	0.90	4/3/89	4/5/89	12	0.385
44	2.00	4/3/89	4/5/89	12	0.329
				12	0.257 (duplicate)
41	1.10	4/4/89	4/6/89	12	0.341
14	0.81	4/4/89	4/6/89	12	0.135
28	1.10	4/5/89	4/7/89	12	0.308
30	Not Sampled	3/27/89 (no cleaning)	3/28/89	12	1.27
		3/30/89	4/3/89	12	0.630
		4/7/89	4/10/89	12	0.934
		4/11/89	4/11/89	8	0.514
				8	0.529 (duplicate)
				8	0.340****

TABLE 5-1 (Continued)

ANALYTICAL RESULTS SUBSEQUENT TO CLEANING
OF CERTAIN YEARGIN EMPLOYEES' HOMES

EPA ID No.	EPA Sampling Results (ug/m³)	Clean-Up Date	Analysis Date	Sampling Duration (hrs.)	Dosimeter Analysis Results (ug/m³)
10	Not Sampled	4/12/89	4/12/89 (no cleaning)	8 8	0.089 0.073 (duplicate)

Note: Homeowner #13 declined sampling of his house and possible cleaning.
Homeowner #29 declined sampling of his house and possible cleaning.

Home occupant #12 lived in a motel during the time of the incident. EPA indicated that it was not necessary to clean the motel room since any occupant exposure (if any) would be short term.

Homeowner #45 could not be located during this period of the project. One homeowner indicated to the EPA OSC that he returned to town during the weekend of April 15, 1989.

* Occupant #11 had lived in two homes during the course of the investigation. Both of these homes were sampled and were approved by the EPA OSC.

** Tygon tubing had been reattached to the end of the dosimeter during sampling by the home occupant. The validity of the above result is questionable due to this.

*** The results of 0.405 ug/m³ and 0.529 ug/m³ were obtained from two consecutive samplings of 12 hours each over a 24-hour period.

**** Carbon adsorption tube result.

5.3 SUMMARY

Between March 20, 1989 and May 14, 1989, 25 houses were tested and cleaned under the supervision of ERM-Southeast, Inc personnel and approved by the EPA. In addition, Yeargin employees cars were tested and cleaned if necessary. The EPA OSC indicated verbally that the terms of the Order had been complied with in a satisfactory manner.

2 8 0080

Break: 2.8
Other:

Agency for Toxic Substances and Disease Registry

Division of Health Studies

FINAL REPORT
Technical Assistance to the Tennessee Department of Health and Environment

Mercury Exposure Study
Charleston Tennessee

December 1990

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for
Toxic Substances and Disease Registry
Atlanta, Georgia 30333

In 1980, Congress created the Agency for Toxic Substances and Disease Registry (ATSDR) to implement health-related sections of laws that protect the public from hazardous wastes and environmental spills of hazardous substances. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), commonly known as the "Superfund" Act, designated ATSDR as the lead agency within the U.S. Public Health Service to help prevent or reduce further exposure to hazardous substances and adverse health effects that result from such exposures, and also to expand the knowledge base about such effects.

This publication reports the results and findings of a health study, registry, or other health-related activity supported by ATSDR in accordance with its legislative mandate described above.

Comments regarding this report are welcome. Please address to:

Agency for Toxic Substances and Disease Registry
Attn: Director, Division of Health Studies (E-31)
1600 Clifton Road, N.E.
Atlanta, Georgia 30333

Agency for Toxic Substances
and Disease Registry.....William L.Roper,M.D.,Administrator
Barry L.Johnson,Ph.D.,Assistant Administrator
John S.Andrews Jr.,M.D.,Associate Administrator for Science

Division of Health Studies.....Jeffrey A.Lybarger,M.D.,Director
Sharon S.Campolucci,Deputy Director

Health Investigations Branch.....Robert W.Amler,M.D.,Chief
Brenda J Coull
Marcelina Edwards
Suzanne Gaventa
Leslie J.Hutchinson,M.D.
Paul A.Jones
Betty L.Phifer
Bonnie S.Richter,Ph.D.
Sara Moir Sarasua
Gale E.Savage,M.D.
Fred L.Stallings,M.D.
J.Michael Straight,M.D.

Epidemiology and Surveillance Branch.....Wendy E.Kaye,Ph.D.,Chief

Exposure and Disease Registry Branch.....JeAnne R.Burg,Ph.D.,Chief

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY
ATLANTA, GEORGIA 30333

FINAL REPORT
TECHNICAL ASSISTANCE TO THE TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT

MERCURY EXPOSURE STUDY
CHARLESTON, TENNESSEE

This study and the final report were supported by funds from the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) trust fund.

DISCLAIMER

The use of company or product names is for identification only and does not constitute endorsement by the Agency for Toxic Substances and Disease Registry, the Public Health Service, or the U.S. Department of Health and Human Services.

Publication clearance, April 1, 1990

TABLE OF CONTENTS

DISCLAIMER ii

ABSTRACT 1

INTRODUCTION 2
Objectives 2

BACKGROUND 2
Historical Perspective 2
Environmental Sampling 3
Human Exposure 4

METHODS 4
Study Design Rationale 4
Study Population 4
Data Collection 5
Interviewing 5
Study instrument 5
Biologic specimens 5
Environmental samples 6
Data Entry 6
Data Analysis 6

PRIVACY AND NOTIFICATION 7
Informed Consent 7
Data Protection and Privacy 7
Community Notification 8

RESULTS 8
Participation 8
Description of the Study Participants 8
Univariate Analysis 9
Multivariate Analysis 10

DISCUSSION 11

CONCLUSIONS 12

RECOMMENDATION 12

AUTHOR AND ACKNOWLEDGMENTS 13

REFERENCES 14

TABLES

Table 1. Descriptive characteristics of the household members of workers exposed to elemental mercury. Mercury Exposure Study, Charleston, Tennessee, December 1988 15

Table 2. Distribution of biologic and environmental levels of mercury. Mercury Exposure Study, Charleston, Tennessee, December 1988 16

Table 3. Mean urine mercury levels by age and sex. Mercury Exposure Study, Charleston, Tennessee, December 1988 17

Table 4. Odds ratios and 95% confidence intervals for urine mercury levels by air-sample data and laundry-related activities among study participants. Mercury Exposure Study, Charleston, Tennessee, December 1988 18

Table 5. Odds ratios and 95% confidence intervals for urine mercury levels by housekeeping activities among study participants. Mercury Exposure Study, Charleston, Tennessee, December 1988 19

Table 6. Odds ratios and 95% confidence intervals for urine mercury levels by other risk factors among study participants. Mercury Exposure Study, Charleston, Tennesee, December 1988 20

Table 7. Indicator variables used in the logistic regression models. Mercury Exposure Study, Charleston, Tennessee, December 1988 21

ATTACHMENTS

A. Letters to participants

B. Questionnaire

C. Urine collection instructions

D. Laboratory protocol

E. Participant consent forms

F. Laboratory result form

ABSTRACT

Workers at a chlor-alkali chemical plant were exposed to high levels of elemental mercury during a scheduled maintenance operation. Evidence suggested that they transported mercury from their place of employment into their homes. Concerns about mercury exposure of the families of these workers prompted a health study to assess the extent of mercury exposure. The first objective of the study was to determine whether the household members had elevated levels of urine mercury. The second objective was to determine any association between levels of urine mercury and potential risk factors for exposure, such as household air and housekeeping activities, and personal risk factors, such as recent dental fillings.

The levels of urine mercury among household members of the exposed workers were within the reference range for the general population and were not indicative of mercury toxicity. The mean value of urinary mercury was 5.1 $\pm$ 4.4 ng/ml. We found that individuals who lived in households that were vacuumed were more likely to have had higher levels of urine mercury than were those who did not. Floor washing was also associated with higher levels of urine mercury.

The mean air level of mercury determined by 12-hour sampling in the homes of these families was 0.92 $\pm$ 0.85 ug/m^3. Mercury decontamination was subsequently conducted in houses where air concentrations of mercury exceeded 0.5 ug/m^3.

INTRODUCTION

Workers at a chlor-alkali chemical plant were exposed to high levels of elemental mercury during a scheduled maintenance operation. It was suggested that they transported mercury from their place of employment into their homes. Because of concerns about potential mercury exposure of the families of these workers, the Tennessee Department of Health and Environment requested technical assistance from the Agency for Toxic Substances and Disease Registry (ATSDR). Accordingly, the Epidemiology and Medicine Branch, Office of Health Assessment, ATSDR, developed an exposure study to assess the extent of mercury exposure among the household members and the possible need for intervention.

Objectives

The first objective of this study was to determine whether the household members of workers exposed to elemental mercury had elevated levels of urine mercury. The second objective was to determine any association between mercury levels in household air samples and urine levels of mercury. In addition, other potential sources of mercury exposure were examined.

BACKGROUND

Historical Perspective

On August 22, 1988, the Olin Chemical Company contracted employees of the Yeargin Construction Company to replace pipes and fittings at the Charleston, Tennessee facility. Oxyacetylene torches were used to cut the pipes. Some of the pipes were reported to contain elemental mercury, and the workers found it necessary to volatilize the mercury with their torches before the cuts could be made. According to worker accounts, the volatilized mercury condensed on the ceiling and fell back on the floor as mercury "rain". The workers were exposed to these conditions for up to 16 hours. The available protective clothing consisted of disposable Tyvek suits, short rubber boots, and cartridge respirators, although reportedly, respiratory protection was not used. Work gloves, clothes, and boots were soaked with mercury. The workers reported that they did not shower at the end of the work day.

The workers returned home in their personal vehicles that evening. Contamination of the workers' vehicles and residences likely occurred via contact with their clothing and tools, which were visibly contaminated with mercury. Washing machines at the workers' homes were used to launder work clothes.

The Environmental Protection Agency (EPA) was notified about the incident on October 24, 1988, by a worker who was concerned about the health of his wife who, he feared, was exposed to mercury as a result of home contamination.

Mr. Chuck Pietrosewicz, ATSDR representative for Region IV, was contacted, and a request was made for technical assistance. On October 26, the ATSDR Emergency Response Branch was briefed on the situation. Using preliminary medical and background information, ATSDR informed EPA that a potentially serious incident had occurred and that additional information was needed before the situation could be completely evaluated.

As a result of the exposure to mercury at the Olin facility, many of the workers developed symptoms of mercury toxicity and sought medical treatment. As of October 27, 1988, 25 of 53 workers were seen at the Vanderbilt University Medical Center, and of these, 20 received chelation therapy. The 24-hour urine levels of mercury for these workers ranged from 25 to 200 ng/ml.

Environmental Sampling

On November 2-4, the Environmental Services Division, Region IV of the EPA, conducted air monitoring (EPA memorandum, 11/8/1988, "Air monitoring results from mercury screening of Olin Construction workers' homes"). Initially, the homes of six exposed workers were selected for environmental mercury testing. All these homes had mercury concentrations greater than 0.5 ug/m^3 (using Jerome dosimeter collection tubes), higher than the level suggested to protect the public's health in the ATSDR preliminary health assessment (1). Because of this, it was determined that all of the workers' homes that could have been exposed to high levels of mercury should be tested. The environmental sampling results from the initial six plus the remaining 39 workers' homes (n = 45) were used in the analysis of this study.

A Jerome Model 511 instantaneous mercury analyzer was used to locate areas of high mercury concentration in the 6 homes. By this method, air mercury concentrations in living areas of the houses ranged from below detection (2.0 ug/m^3) to 5.9 ug/m^3. High mercury concentrations were detected over washing machines (54.0 ug/m^3) and sinks (7.0 ug/m^3). Elevated levels of air mercury were detected inside workers personal vehicles (8.1 - 10 ug/m^3).

Air samples were collected from living quarters (primarily living rooms) over a 12-hour period using a Jerome dosimeter collection tube and an Alpha battery-powered sampling pump. The minimum detection limit for this method was 0.1 ug/m^3. Air concentrations using this method ranged from 1.0 to 5.0 ug/m^3.

Human Exposure

The recommended exposure limit (REL) (8-hour time-weighted average) for inorganic mercury in the air at the workplace is 50 ug/m^3 (2). This REL assumes healthy, adult workers, but may not be relevant to the general population, which includes children, the elderly, and others who may be especially vulnerable to mercury toxicity. In the 1986 Superfund Public Health Evaluation Manual, EPA recommended that chronic exposure to mercury in air not exceed a concentration of 0.18 ug/m^3 (3).

Metallic mercury volatilizes at ambient temperatures. Mercury vapor readily diffuses across the alveolar membranes of the lungs, and an estimated 80% is absorbed (4). Metallic mercury may be absorbed to a lesser extent through the skin upon direct dermal contact (4). Because elemental mercury can cross the placenta, a fetus may be exposed to mercury from its mother's blood. Mercury is slowly eliminated from the body by fecal and urinary excretion. The biologic half-life of mercury vapor in blood is in the range of 35 - 95 days.

METHODS

Study Design Rationale

The Tennessee Department of Health and Environment requested the assistance of ATSDR to determine whether mercury exposure occurred among household members of workers exposed to elemental mercury at their workplace. In addition, a cross-sectional exposure study was designed to determine whether data from household-air sampling was associated with the concentrations of urine mercury and to identify possible locations and activities associated with exposure.

Study Population

A total of 53 workers were identified as being exposed to mercury at the Olin facility. Although little demographic information was available at the time of the incident, some of the workers were known to be married and to have children at home. We expected to identify between 120 and 180 persons potentially exposed. The families lived within a 40- to 45-mile radius of the facility in a rural, mountainous area of east Tennessee. The population at risk consisted of family members and persons living in or spending considerable time in the homes of workers who were exposed to mercury in the incident described above.

All household members aged 6 months and above, with the exclusion of actual workers who were involved in the maintenance operation at the Olin facility, were eligible to participate. The National Institute for Occupational Safety and Health was consulted in follow-up health issues related to the workers. A person was considered a member of the household if he or she lived at or spent a considerable amount of time at the house (such as children in day care).

The Olin Chemical Corporation and Yeargin Construction Company provided ATSDR with the names of workers employed during the incident so their families could be contacted. One of the workers also contacted EPA with a list of names, and we believe that all potentially exposed workers were identified. In addition, arrangements were made with NIOSH for the release of names and addresses of the workers. We also provided the physician at Vanderbilt Medical Center with contact-release forms in the event that all workers were not identified through the three aforementioned sources.

Data Collection

Interviewing. Participants were contacted and interviewed in-person by a door-to-door interviewer. To insure comparability of data obtained by different interviewers, all interviewers were required to participate in a training workshop. During the course of data collection, all questionnaires were reviewed for completeness and checked for inconsistencies. When necessary, study participants were re-contacted to clarify answers or supply missing information.

To increase study participation and facilitate interviewing, a letter was mailed or delivered to each household informing the residents about the study (Attachment A). Second letters were left at the homes of residents who did not respond to the first contact (Attachment A).

Study instrument. An interviewer-administered questionnaire was used as the study instrument (Attachment B). This questionnaire was designed to ascertain demographic characteristics, identify potential sources of mercury exposure in the home, and identify potential confounding variables. A questionnaire was administered to one consenting adult (other than the worker) per household. In the event that the worker was the only household member, that household was ruled ineligible for inclusion in the study and no further follow-up conducted.

Biologic specimens. Each participant was given verbal instructions for urine collection and was provided with a specimen cup and written instructions (Attachment C). A pediatric, urine-collection bag was used to collect urine from infants who were not yet toilet trained. A member of the study team picked up the urine specimens at the participants' homes and delivered them to the laboratory technician.

Biologic specimens consisting of the first urine voided each morning were analyzed for mercury, creatinine, and specific gravity. The Division of Environmental Health Laboratory Sciences, Center for Environmental Health and Injury Control (CEHIC), Centers for Disease Control (CDC), Atlanta, conducted the urine analysis (Attachment D). Urine concentrations of mercury were determined by cold-vapor, atomic absorption using a method by Littlejohn (5). Urine creatinine analysis was conducted using a method by DuPont (6).

In the event that no one was home, multiple attempts were made by the study team at various hours of the day by telephone, or in person, to reach the household until an interview could be completed. A household that could not be contacted was considered a non-respondent at the completion of the survey period.

Environmental samples. The Environmental Services Division, Region IV, of EPA provided us with air sampling data (7). Forty-five homes were tested for mercury in November and December 1988. Two participants refused to have their homes sampled, and EPA could not locate one house. A 12-hour air sample was taken at each home using a Jerome dosimeter tube, an Alpha battery-powered sampling pump, and a Jerome Model 511 analyzer. The units were placed in the primary living quarters (e.g., the living room) of each home. By drawing approximately 36 liters of air through the dosimeter tubes during each 12-hour period, we obtained a lower detection limit of 0.1 ug/m^3.

The instruments were calibrated before operation, and duplicates were run to insure quality control. A small number of homes not associated with the workers were sampled to determine the background level of mercury in the Charleston area. The dosimeter tubes were reported to have an average precision of $\pm$ 5% and an average collection efficiency of 95%. The background mercury concentrations were less than the lower detection limit (<0.1 ug/m^3).

Data Entry

The data were of three types: household questionnaire answers, laboratory analyses of urine specimens, and mercury concentrations in environmental air samples. The data were edited for coding and keypunch errors. Internal consistency checks were run during data cleaning. The three data sets were then merged into a single database. Statistical analyses were performed using release 5.16 of SAS (8) on the CDC mainframe computer (IBM 3090-200E).

Data Analysis

Urine mercury values were adjusted by urine creatinine to account for differences in urine concentration using the following formula:

$$\text{Urine Mercury (ug)/g Creatinine} = \frac{\text{UHg (ng/ml)}}{\text{UCr (mg/ml)}} \times 100$$

where UHg = urine mercury
UCr = urine creatinine

The analytic techniques used in this study were those appropriate for a cross-sectional study design. The analysis included simple descriptive statistics on the interview and laboratory data. Student's t-test was used to compare differences in the means of continuous variables. A test was considered of borderline statistical significance if $0.05 < p \leq 0.10$.

Univariate and multivariate analyses were used to examine the association among potential risk factors and urine mercury concentration. Because of the skewed distribution of urine mercury concentrations, the natural logarithm transformation of these data was used. For analysis purposes, the mercury concentrations were dichotomized into categories using the median value of the entire study population. One category was for values < 3.8 ng/ml and the other category for those values ≥ 3.8 ng/ml. The odds ratio and 95% confidence interval were used to determine the strength of association between the dependent and independent variables.

Logistic regression was used in the multivariate analysis to adjust for the effects of multiple risk factors and confounding variables. The dependent variable was the logarithm of the urine mercury level dichotomized into the upper and lower median value. The independent variables included in the model were those found statistically significant in the univariate analysis and all potentially confounding variables. The odds ratio was calculated by taking the antilogarithm of the parameter estimates (beta) determined from the maximum likelihood estimate. A step-down approach was used to determine the model that best fit the data, and the likelihood ratio test was used to determine the goodness of fit between models. A variable was retained in the model if the p-value was ≤ 0.05.

PRIVACY AND NOTIFICATION

Informed Consent

All study participants were asked to give their informed consent before they participated in the survey (Attachment E). The consent statement informed them of the study purpose and disclosed confidentiality precautions. Parents or legal guardians were asked to give consent for minors.

Data Protection and Privacy

Under the Privacy Act of 1974 (5 U.S.C.) Section 552a(e), employees of federal agencies are responsible for protecting data collected on identifiable persons or organizations when the supplier of those data has not given consent to make the data public. This responsibility for protection extends to unauthorized visual observation and accidental loss or theft of data. This implies that confidential records should be kept out of sight of unauthorized persons, stored in locked cabinets or locked rooms when not being used, copied only when absolutely necessary, and

stored in sealed containers when transferred to archives. Reports of statistics derived from such data must be presented in ways that will avoid inadvertent disclosure about particular study subjects.

Each study participant was assigned a unique study number for identification. Names and addresses were stored separately from the information gathered. The final report contains aggregate data only; results are not associated with any specific individual participant. Identifiers were relinquished only to the Tennessee State Department of Health and Environment for the purpose of notifying participants of their laboratory mercury results.

Community Notification

Laboratory data were reviewed to determine whether any of the subjects had elevated levels of mercury in their urine. The determination of elevated mercury exposure was based on the laboratory reference values and other published reference values.

Each participant was mailed the results of his or her laboratory test for urine mercury, and the creatinine-adjusted mercury concentration. Attached to these results was an interpretation of the test and recommendations for specific action, where appropriate (Attachment F). This information was transmitted to the study subjects or to the parents or guardians of child subjects with a cover letter from the Tennessee Department of Health and Environment.

RESULTS

Participation

Fifty-three workers representing 51 households were identified from the list provided by the Yeargin Construction Company; of these, 2 households had 2 workers each. One household was eliminated from the study because the worker was not at the Olin plant on the day of the incident. Five households (9.8%) could not be located by our interviewers or EPA. Interviews were obtained from residents of the remaining 45 households. No refusals were received among the located households, resulting in a participation rate of 100%.

Description of the Study Participants

We identified 163 individuals in the 45 households included in this study. Of the 116 eligible participants (after excluding the 47 Yeargin workers), 1 (0.8%) did not provide a urine sample and was therefore eliminated from the analysis. Ten (8.7%) of the 115 participants did not live at a worker's home, but spent considerable time there and, therefore, were included in the study because they were thought to be at risk of mercury exposure. These participants were primarily children (mean age 4.4 $\pm$ 4.5) in home day-care situations.

The descriptive characteristics of the study population are shown in Table 1. The mean age of the participants was 23.1 ± 17.1. The mean educational grade completed for participants ages 18 or older (n = 60) was 10.9 ± 2.4.

Table 2 shows data from the urine and environmental mercury sampling. Urine levels of mercury ranged from 0.2 to 26.9 ng/ml, the mean was 5.1 ± 4.4 ng/ml. Values for two individuals exceeded the suggested reference value of 20 ng/ml (9) (23.7 ng/ml and 26.9 ng/ml). After adjusting for creatinine, the mean urine level of mercury was 4.4 ug/g ± 3.6, and the range was 0.5-16.3 ug/g. The 12-hour household air monitoring data ranged from 0.1 to 5.0 ug/m^3, the mean mercury concentration was 0.92 ± 0.85 ug/m^3. Air mercury concentrations exceeded 0.5 ug/m^3 in 25 homes.

Mean and geometric mean levels of mercury by age and sex are shown in Table 3. Urine levels of mercury did not differ statistically by age group or between males and females. The mean urine level of mercury for children (those under age 11) who were not household residents was 2.9 ± 1.7 ng/ml, and the level for resident children was 4.9 ± 3.5 ng/ml.

Univariate Analysis

Table 4 presents odds ratios and 95% confidence intervals for urine levels of mercury (lowest versus highest median) by potential sources of exposure. No statistically significant association existed between the 12-hour, air-sampling levels and urine mercury levels. Worker hygiene, such as where soiled work clothing was changed or kept, was not associated with elevated levels of mercury among other household members. The household member who washed the worker's clothing was no more likely to have an elevated mercury level than were other members of the household (11 years of age or older) who did not do the laundry. Persons who did the wash were only 1.63 times (95% confidence interval (CI) 0.66 - 3.91) more likely to have a urine level of mercury ≥ 3.8 ng/ml when compared with persons who did not; no statistically significant association was found with the number of loads washed per week.

Thirty-nine of the 40 persons who did the laundry were women (5 households did not have washing machines). Children who played within 10 feet of the washer or dryer were not at risk for elevated mercury levels compared to with children who did not. No association was found between urine levels of mercury among the household members and the location of the exhaust ventilator for the clothes dryer.

The association between housekeeping activities and urine levels of mercury were examined, and the results are shown in Table 5. No association was found between urine levels of mercury and the reported sighting of balls of mercury in the home. We tried to determine whether the person who cleaned the house was at increased risk of exposure. Because we had not identified the individual who vacuumed or washed the

floor, we made the assumption that the same person who did the laundry also performed these other housekeeping tasks. Using this assumption, the person who vacuumed was no more at risk for elevated mercury levels than were other members of the household (aged 11 or older) who did not vacuum. The level of risk was not associated with the number of times a person vacuumed.

We also examined the possible association between urine levels of mercury and exposure to vacuuming for all household members regardless of who performed this activity. Persons exposed to household vacuuming from one to eight times per month were 5.4 times (95% CI 1.2 - 24.8) more likely to have urine levels of mercury > 3.8 ng/ml compared with persons who lived in households that were not vacuumed. The odds ratio was 5.9 (95% CI 1.3 - 26.9) for individuals whose households were vacuumed nine or more times per month compared with participants whose homes were not vacuumed.

Assuming that persons who did the laundry also washed the floor, floor washers were no more likely to have an elevated urine level of mercury than were persons who did not. However, after stratifying by the frequency of washing, persons who were assumed to wash the floor four or more times per month were 11 times (95% CI 1.9 - 68.6) more likely to have an elevated urine level of mercury than were persons who did not wash the floor. No apparent risk was associated with floor washing among household members who did not participate directly in this activity.

We were informed that some households had their vacuum cleaners and other mercury-soiled articles, such as clothing, removed from the premises. As shown in Table 6, no association existed between mercury exposure and the presence or removal of such articles. No personal risk factors, such as recent tooth fillings which contained mercury, or mercurochrome use, were identified. The source of home heating was not associated with elevated urine levels of mercury.

Multivariate Analysis

Logistic regression was used to adjust for the effect of several covariables shown in Table 7. Two different regression models were created using those variables shown to be statistically significant in the univariate analysis, or thought to be potentially confounding. Indicator or "dummy" variables were created for the continuous data, participant age, and the frequency of floor washing per month.

The first model was used to examine the association among the 115 participants between urine mercury concentration and the variables of age, sex, and whether the household was vacuumed. Using a backward elimination procedure comparing maximum likelihood estimates, vacuuming and the age range of 20-29 were statistically significantly associated with urine mercury levels. Participants living in homes that were vacuumed were 8.45 times (95% CI 1.49 - 47.81) more likely to have urine mercury ≥ than 3.8

ng/ml than were participants living in homes that were not vacuumed. Compared with participants aged 30-39, those aged 20-29 were 4.35 times (95% CI 1.06 - 17.55) more likely to have elevated mercury levels.

The second regression model was restricted to household members aged 11 or older (n = 85) and was used to examined the association of age, sex, and floor washing with the risk of elevated mercury concentrations. No statistically significant association was found between urine levels of mercury and age or sex. Individuals who washed their floors 5-30 times per month were 11.9 times (95% CI 4.14 - 96.29) more likely to have urine levels of mercury $\geq$ 3.8 ng/ml than were those who did not wash their floors. No apparent increase in risk was found for persons who washed their floors 1-4 times per month.

DISCUSSION

Mercury is excreted in the urine, and urinary mercury levels correlate with recent exposure (10). Household members of workers exposed to mercury in the present job-related incident were not found to have elevated values of urine mercury. Indeed, the mean value 5.1 ng/ml was well below a suggested reference value for the general population of 20 ng/ml (9). All urine levels were well below concentrations indicating mercury toxicity (50-100 ug/l) (11). The mean urine level of mercury adjusted for creatinine was 4.4 ug Hg/g creatinine. Although no reference value has been established for urine mercury adjusted for creatinine, one occupational study reported 4.2 ug Hg/g creatinine among the control (unexposed) group (12).

The mean air level of mercury in the workers' homes was 0.92 ug/m^3 determined by 12-hour sampling. Mercury decontamination cleaning was subsequently conducted in 25 homes where air mercury concentrations exceeded 0.5 ug/m^3. Following cleanup efforts, the indoor air concentrations of mercury ranged from non-detectable to 0.58 ug/m^3. The post-cleanup concentrations of mercury detected in indoor air would not be expected to pose a significant health risk.

We examined the association between mercury levels and personal and household activities. With the exception of vacuuming and floor washing, no risk factors for elevated mercury levels were identified. Hudson, et al (13) examined risk factors for mercury exposure among children of thermometer plant workers but could not identify any personal risk factors (such as recent tooth filling, tendency to play near washing machine) for elevated urine levels of mercury. These authors suggested that exposure depended on household factors (such as type of parental job, duration of employment, or taking work clothes home).

Individuals in the present study who lived in homes that were vacuumed were eight times more likely to have elevated urine levels of mercury than were those who did not. The risk of exposure is probably attributable to the inhalation of mercury vapors. Vacuuming may contribute to elevated air levels by two possible mechanisms: 1) mercury is aerosolized, and 2) mercury is heated and vaporized as it passes over the vacuum cleaner motor. In fact, a very statistically significant correlation existed between elevated air levels and vacuuming (Pearson correlation coefficient = 0.34, $p = 0.0002$).

The individuals who washed the floors five or more times per month were also at risk for elevated urine mercury compared with those that did not wash the floor. The risk of exposure may be due to direct contact with mercury-contaminated mops and water or to inhalation of mercury vapors. Although percutaneous absorption of mercury vapor is possible, vapor inhalation more likely poses the greater risk.

One possible limitation of this study is that we did not identify the persons who actually washed the floors and vacuumed. We made the assumption that the person who did the laundry also did these other tasks. However, we do not think this assumption introduced any spurious association into the analysis because the family structure in these households was very traditional (women took care of the home). A second limitation of this study is the assumption that the 12-hour air sample is representative of current and past mercury exposure in the home.

CONCLUSIONS

The urine levels of mercury among household members of workers exposed to mercury were within the reference range and were not indicative of mercury toxicity.

The association between elevated levels of mercury and certain housekeeping activities in this study was found in a population with low urine levels of mercury and should probably not be generalized to persons with occupational exposure to mercury. However, the data do indicate that persons involved in the clean-up of contaminated residences should be considered at risk of mercury exposure, and good hygiene practices should be adhered to.

RECOMMENDATION

No further follow-up is recommended for the participants in this study.

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Author

Bonnie S. Richter, Ph.D. (Principal Investigator)

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Table 1. Descriptive characteristics of the household members of workers exposed to elemental mercury. Mercury Exposure Study, Charleston, Tennessee, December 1988

Characteristic	Number of participants	Percentage
Age (years)		
6 mos - 4	15	13.0
5 - 9	13	11.3
10 - 19	32	27.8
20 - 29	15	13.0
30 - 39	17	14.8
40 - 49	16	13.9
50 - 79	7	6.1
Total	115	100.0
Sex		
male	40	34.8
female	75	65.2
Total	115	100.0
Residents per household *		
2	13	28.9
3	13	28.9
4	12	26.7
5	5	11.1
6	1	2.2
9	1	2.2
Total	153	100.0
Education (grade completed) for persons aged ≥ 18 years		
1 - 6	3	5.0
7 - 11	20	33.3
12	29	48.3
college/technical/trade	8	13.3
Total	60	100.0

* Does not include 10 persons identified as non-residents who were included in the study because of daily visits to the homes for considerable periods of time.

Table 2. Distribution of biologic and environmental levels of mercury. Mercury Exposure Study, Charleston, Tennessee, December 1988

Characteristic	Number	Percentage
Urine mercury (ng/ml)		
0 - 4.9	69	60.0
5 - 9.9	32	27.8
10 - 14.9	11	9.6
≥ 15	3	2.6
Total	115	100.0
Urine mercury adjusted for creatinine (ug/g)		
0.5 - 1.9	26	23.4
2.0 - 2.9	25	22.5
3.0 - 5.9	33	29.7
≥ 6.0	27	24.3
Total	115	100.0
12-hour household-air sample (ug/m^3)		
0.10 - 0.29	11	26.2
0.30 - 0.59	10	23.8
0.60 - 0.89	4	9.5
≥ 0.90	17	40.5
Total	42	100.0

Table 3. Mean urine mercury levels by age and sex.
Mercury Exposure Study, Charleston, Tennessee, December 1988

Characteristic	Mean (ng/ml)	S.D.	Geometric mean (ng/ml)	S.D.
Age (years)				
6 mos - 4	4.0	3.3	2.7	2.9
5 - 9	4.3	4.2	3.0	2.5
10 - 19	5.7	4.4	4.5	2.0
20 - 29	6.0	3.7	5.0	2.3
30 - 39	5.6	7.2	4.1	2.1
40 - 49	5.1	4.1	3.2	3.1
50 - 79	1.8	1.6	1.6	3.0
	p = 0.47		p = 0.06	
Sex				
male	5.2	5.6	3.4	2.5
female	4.8	3.4	3.5	2.4
	p = 0.69		p = 0.77	

Table 4. Odds ratios and 95% confidence intervals for urine mercury levels by air-sample data and laundry-related activities among study participants.
Mercury Exposure Study, Charleston, Tennessee, December 1988

Source of potential exposure	Number of urine samples < 3.8 ng/ml	≥ 3.8 ng/ml	Odds ratio	95% CI
Air 12-hour sample (ug/m^3)				
≤ 0.5	23	32	1.00	
> 0.5	32	28	0.63	0.30 - 1.32
Area where worker changes clothes				
inside house	49	53	1.00	0.25 - 3.45
laundry area	5	5	0.92	
Area where dirty clothes are kept				
inside house	30	33	1.00	
laundry area	22	22	1.10	0.51 - 2.39
Washes laundry				
no	21	24	1.00	
yes	14	26	1.63	0.66 - 3.91
Washes laundry # loads/week				
0	21	24	1.00	
1 - 9	8	14	1.53	0.53 - 4.39
≥ 10	6	12	1.75	0.56 - 5.48
Children's play area				
not near washer	5	4	1.00	
near washer	5	16	4.00	0.78 - 20.00
Drier ventilation				
outside	4	1	1.00	
inside	47	44	3.74	0.53 - 33.33

Table 5. Odds ratios and 95% confidence intervals for urine mercury levels by housekeeping activities among study participants. Mercury Exposure Study, Charleston, Tennessee, December 1988

Risk Factor	< 3.8 ng/ml	≥ 3.8 ng/ml	Odds ratio	95% CI
Mercury balls sighted in home				
no	40	46	1.00	
yes	15	14	0.81	0.35 - 1.89
Vacuums house[a]				
no	22	26	1.00	
yes	13	24	1.56	0.65 - 3.79
Vacuums[a] # times/month				
0	22	26	1.00	
1 - 8	6	13	1.83	0.60 - 5.63
9 - 60	7	11	1.33	0.44 - 4.04
Exposed to vacuuming # times/month				
0	9	2	1.00	
1 - 8	24	29	5.43	1.19 - 24.76
9 - 60	22	29	5.93	1.30 - 26.90
Washes floor[a]				
no	22	25	1.00	
yes	13	25	1.69	0.70 - 4.10
Washes floor[a] # times/month				
0	22	25	1.00	
1 - 4	12	12	0.88	0.33 - 2.37
4 - 30	1	13	11.44	1.91 - 68.64
Exposed to floor washing # times/month				
0	3	3	1.00	
1 - 4	33	25	0.76	0.14 - 4.11
5 - 30	19	32	1.68	0.31 - 9.21

[a] Individual performs activity

Table 6. Odds ratios and 95% confidence intervals for urine mercury levels by other risk factors among study participants. Mercury Exposure Study, Charleston, Tennessee, December 1988

Risk Factor	< 3.8 ng/ml	≥ 3.8 ng/ml	Odds ratio	95% CI
Vacuum cleaner removed				
no	32	39	1.11	0.48 - 2.57
yes	14	19		
Removed other articles				
no	45	45	1.50	0.61 - 3.70
yes	10	15		
Dental filling				
no	46	51	1.05	0.33 - 3.38
yes	6	7		
Used mercurochrome				
no	53	55	2.4	0.47 - 12.43
yes	2	5		
Home heating				
wood	14	15	1.00	
gas/electric	32	37	0.93	0.39 - 2.22
other	8	9	1.21	0.36 - 4.05

Table 7. Indicator variables used in the logistic regression models. Mercury Exposure Study, Charleston, Tennessee, December 1988

Age1
6 months - 4 years (1)
else (0)

Age2
5 - 9 years (1)
else (0)

Age3
10 - 19 years (1)
else

Age4
20 - 29 years (1)
else (0)

Age5
40 - 49 years (1)
else (0)

Age6
50 - 79 years (1)
else (0)

Sex
male (1)
female (0)

Household vacuumed
yes (1)
no (0)

Floorwasher1
1 - 4 times/month (1)
else (0)

Floorwasher2
5 - 30 times/month (1)
else (0)

Reference groups - Age: 30-39 years
Floorwasher: 0 times/month

Attachment A

2 8 0108

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT
CORDELL HULL BUILDING
NASHVILLE, TENNESSEE 37219-5402

December 1, 1988

Dear Resident:

We are asking for your help with an important health survey that will take place during the week of December 5. Only a minimal amount of time will be needed, and your participation is entirely voluntary.

We are conducting the survey with assistance from the U.S. Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR). The survey is intended to determine mercury levels in the urine of families of workers who were exposed to mercury during the course of a scheduled maintenance operation at Olin Chemical Company on August 22, 1988.

You will be contacted soon by a representative of ATSDR. This representative will be able to explain the survey in detail to you. Your participation will include answering a questionnaire and providing urine specimens from each household member (except the worker). Urine specimen cups and instructions will be provided by the ATSDR respresentative.

I hope we can count on your help with this important survey. If you have any questions, please call our office at (615) 741-5683, or the survey team at the temporary phone number listed below.

Sincerely,

Patrick A. Turri, Director
Environmental Epidemiology

Survey Team Phone Number: (615) 476-0568

PAT/kr

NOT-AT-HOME LETTER (WILL BE PRINTED LETTERHEAD PAPER FROM THE TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT)

Dear Resident,

We are conducting the survey with assistance from the U.S. Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR). The survey is intended to determine mercury levels in the urine of families of workers who were exposed to mercury during the course of a clean up operation at Olin Chemical Company.

A member of the ATSDR survey team stopped by to inform you of the survey. (You may already have received a written notice concerning the survey from the Tennessee Department of Health and Environment.)

Since the team member was unable to speak with you today, would you please call the number _____ between the hours of ____ and ___ and a team member will give you details of the survey.

We look forward to talking with you.

Thank You,

_____

Attachment B

2 8 0111

(1- 4) Household No. _ _ _ _

(5- 6) Interviewer number _ _

(7- 12) Date of interview _ _/_ _/_ _

(13- 24) EPA NPL Site Number _ _ _ _ _ _ _ _ _ _ _ _

A. GENERAL INFO -- HOUSEHOLD

1. What is the actual address of the household?

   Street_____Apt._____
   City_____State_____
   Zip code_____

2. What is the mailing address of the household?

   Street_____Apt._____
   City_____State_____
   Zip code_____

3. In whose name is the household?

   _____

4. What is the telephone number of this household?

   (_ _ _) · _ _ _ · _ _ _ _

5. How many people live in this household?

(25- 26) _ _

Household No. _ _ _ _

A. GENERAL INFO -- HOUSEHOLD (CONT.)

6. Please list all the people who live here and provide the information requested for each one. Start with the oldest member and proceed downward in age.

PERSON NO.	NAME	SEX	DATE OF BIRTH	DATE MOVED THIS ADDRESS	EDUCATION	OCCUPATION
01	_____	M-1	MO. _ _	MO. _ _	HIGHEST	_____
	_____	F-2	DAY _ _		GRADE	_____
	_____		YR. _ _	YR. _ _	COMPLETED:	_____
			AGE _ _		_ _	
(27-28)		(29)	(30-37)	(38-41)	(42-43)	

PERSON NO.	NAME	SEX	DATE OF BIRTH	DATE MOVED THIS ADDRESS	EDUCATION	OCCUPATION
02	_____	M-1	MO. _ _	MO. _ _	HIGHEST	_____
	_____	F-2	DAY _ _		GRADE	_____
	_____		YR. _ _	YR. _ _	COMPLETED:	_____
			AGE _ _		_ _	
(44-45)		(46)	(47-54)	(55-58)	(59-60)	

PERSON NO.	NAME	SEX	DATE OF BIRTH	DATE MOVED THIS ADDRESS	EDUCATION	OCCUPATION
03	_____	M-1	MO. _ _	MO. _ _	HIGHEST	_____
	_____	F-2	DAY _ _		GRADE	_____
	_____		YR. _ _	YR. _ _	COMPLETED:	_____
			AGE _ _		_ _	
(61-62)		(63)	(64-71)	(72-75)	(76-77)	

PERSON NO.	NAME	SEX	DATE OF BIRTH	DATE MOVED THIS ADDRESS	EDUCATION	OCCUPATION
04	_____	M-1	MO. _ _	MO. _ _	HIGHEST	_____
	_____	F-2	DAY _ _		GRADE	_____
	_____		YR. _ _	YR. _ _	COMPLETED:	_____
			AGE _ _		_ _	
(78-79)		(80)	(81-88)	(89-92)	(93-94)	

PERSON NO.	NAME	SEX	DATE OF BIRTH	DATE MOVED THIS ADDRESS	EDUCATION	OCCUPATION
05	_____	M-1	MO. _ _	MO. _ _	HIGHEST	_____
	_____	F-2	DAY _ _		GRADE	_____
	_____		YR. _ _	YR. _ _	COMPLETED:	_____
			AGE _ _		_ _	
(95-96)		(97)	(98-105)	(106-109)	(110-111)	

Household No. _ _ _ _

We would like to start by asking you some questions to determine if mercury from the workplace entered your home during the month of August.

7. Please tell me the name(s) of any household member who worked at the Olin Chemical Company on August 22 or 23, 1988.

	Name	ID
(112-113)	_____	_ _
(114-115)	_____	_ _

(116) 8. Does the worker usually remove his/her work clothes at home?
1 = Yes
2 = No (GO TO 9)
9 = Don't know

(117) 8a. Where does the worker usually remove his/her work clothes?
1 = Garage
2 = Laundry area inside the home
3 = Outside the house (tool shed, porch)
4 = Inside the house (bedroom, bathroom)
5 = Other _____
9 = Don't know

(118) 9. Before the dirty work clothes are cleaned, where are they kept?
1 = Garage
2 = Laundry area inside the home
3 = Outside the house (tool shed, porch)
4 = Inside the house (bedroom, bathroom)
5 = Other _____
9 = Don't know

(119) 10. Does the worker usually wear his/her work shoes into the house?
1 = Yes
2 = No
9 = Don't know

(120) 11. Does the worker usually take his/her tools or tool box into the house?
1 = Yes
2 = No
9 = Don't know

(121) 12. On August 22, 1988, the scheduled maintenance operation at Olin Chemical, did the worker change his usual cleanup practices, such as mentioned above?
1 = Yes
2 = No (GO TO 13)
9 = Don't know

12a. If yes, please explain how.

_____

_____

_____

Household No. _ _ _ _

(122) 13. Is there a washing machine in your home?
1 = Yes
2 = No (GO TO 14)
9 = Don't know

(123) 13a. Are work clothes washed at home or sent out to be cleaned?
1 = At home
2 = Sent out
9 = Don't know

(124-125) 13b. Who usually does the laundry?

Name _____ ID _ _

(126-127) 13c. How many loads of laundry are usually done per week? _ _

(128) 14. Do you have a clothes dryer in your home?
1 = Yes
2 = No (GO TO 15)
9 = Don't know

(129) 14a. Where does the clothes dryer vent?
1 = Inside the home
2 = Outside the home
9 = Don't know

(130) 15. Do any children frequently play within 10 feet of the washing machine or dryer?
1 = Yes
2 = No
9 = Don't know

(131) 16. Does any member of this household do any work at home that involves the use of mercury (for example, thermometer or barometer making)?
1 = Yes
2 = No (GO TO 17)
9 = Don't know

16a. If yes, please tell me their names.

	Name	ID
(132-133)	_____	_ _
(134-135)	_____	_ _

(136) 17. Since August, have you had any known exposure to mercury in your home, such as a broken thermometer or barometer?
1 = Yes
2 = No
9 = Don't know

(137) 18. Since August, have you seen any balls of mercury (a silver liquid) in your home?
1 = Yes
2 = No
9 = Don't know

Household No. _ _ _ _

(138) 19. Since August, have you seen any balls of mercury (a silver liquid) in your car or truck?
1 = Yes
2 = No
9 = Don't know

(139) 20. Does any member of this household work in a dental office?
1 = Yes
2 = No (GO TO 21)
9 = Don't know

20a. If yes, please tell me their names.

	Name	ID
(140-141)	_____	_ _
(142-143)	_____	_ _

(144) 21. Does any member of this household work in a job with exposure to heavy metals? Examples of these are: lead, cadmium, nickel, silver or gold.
1 = Yes
2 = No (GO TO 22)
9 = Don't know

21a. If yes, please tell me their names.

	Name	ID
(145-146)	_____	_ _
(147-148)	_____	_ _

(149) 22. How is the home heated?
1 = Wood stove
2 = Coal stove
3 = Oil heat
4 = Forced hot air, gas or electric
5 = Electric baseboard
6 = Other _____
9 = Don't know

(150) 23. Do you own a vacuum cleaner?
1 = Yes
2 = No (GO TO 24)
9 = Don't know

(151-152) 23a. How many times per month do you vacuum your home? _ _

(153) 23b. Has anyone removed the bag to your vacuum cleaner because they said it contains mercury?
1 = Yes
2 = No
9 = Don't know

(154) 24. Have any articles, for example, clothing or tools, been removed from your home because they may have contained mercury?
1 = Yes
2 = No
9 = Don't know

(155-156) 25. How many times per month do you wash the kitchen floor? _ _

Household No. _ _ _ _

(157) 26. Has any household member had a silver tooth filling since August?
1 = Yes
2 = No (GO TO 27)
9 = Don't know

26a. If yes, please give household members name.

	Name	ID
(158-159)	_____	_ _
(160-161)	_____	_ _

(162) 27. Has any household member used Mercurochrome (a red liquid used on cuts and scratches) since August?
1 = Yes
2 = No
9 = Don't know

27a. If yes, please give household members name.

	Name	ID
(163-164)	_____	_ _
(165-166)	_____	_ _

THIS IS THE END OF THE INTERVIEW. THANK YOU FOR YOUR COOPERATION.

Attachment C

URINE COLLECTION INSTRUCTIONS FOR STUDY PARTICIPANTS

1. Collect your first morning urine in the pre-labeled cup. Be sure the correct name is on the cup.

2. To collect the urine sample: Wash your hands with soap and water.

3. Do not open the bag and cup until just before urinating. The inside of the container and cap should not be touched or come in contact with any parts of the body, clothing, or any object.

4. Fill the cup with at least 2 ounces (one fourth of the plastic cup) of urine. Put the lid on the cup as soon as you are through urinating.

5. Place the cup back in the plastic bag. Store it in the refrigerator until it is picked up by the study personnel. **DO NOT FREEZE**

URINE COLLECTION FOR CHILDREN

1. Collect your child's first morning urine in the pre-labeled cup. Be sure the correct name is on the cup.

2. Your child will need help in urinating into the cup.

3. To collect the urine sample: Wash your hands and the child's hands with soap and water.

4. Do not open the bag containing the urine cup and moist towelettes until your child is ready to urinate into the cup.

   For a girl: Use the moist towelette to wipe her bottom once from front to back.

   For a boy: Wipe the tip of the penis with the moist towelette.

5. Have your child urinate into the cup.

6. Put the lid on the cup as soon as the child is finished urinating.

7. Be careful not to let the inside of the cup or lid touch clothes, body, or other objects.

8. Refrigerate the urine sample immediately. Store it in the refrigerator until it is picked up by study personnel. **DO NOT FREEZE.**

Attachment D

COLD VAPOR PROCEDURE FOR URINARY MERCURY
(Revised June 7, 1984)

Determination of mercury in undigested urine is accomplished by cold vapor atomic absorption. Mercury in undigested urine is complexed to L-cysteine in acid solution. At high pH and in the presence of stannous ions, mercury is reduced to elemental mercury. The vapor is flushed through an absorption cell, where the absorbtion of the mercury line at 253.7 nm is measured. The method is based on a published procedure by Littlejohn et al. (1).

APPARATUS

LDC UV Monitor:

Parameter	Setting
Wavelength	253.7 nm
Control unit range	0.16
Path length	30 cm

Flow Through Apparatus: A special reduction apparatus was constructed for the generation of mercury vapors similar to the one described in Littlejohn et al. (1). Reaction flasks of 50 ml were used. The main path of airflow passed through a flowmeter and a valve which is used to redirect the airflow. The air then passes through another valve which is used to seal off the reaction flask during the reaction and into the vessel. The exit for the airflow is through another valve and into a water trap filled with magnesium perchlorate. The airflow then enters the absorption cell and out into the atmosphere after passing through a mercury trap containing activated hopcalite.

Recorder: Perkin-Elmer Model 56, set at 5 mV chart speed at 20 mm/min.

REAGENTS

Water: Ultrapure water, prepared by a Milli-Q polishing system, is used throughout.
Nitric Acid: Redistilled nitric acid (G. Frederick Smith).
L-Cysteine: Reagent grade from Fisher Scientific Co. 10 g/liter in nitric acid (1 mol/liter).
Stannous Chloride solution: 'Baker-Analyzed' reagent from J.T. Baker Chemical Co. 100 g/liter of hydrochloric acid (2 mol/liter).
Stannous Chloride/Cadmium Chloride solution: 'Baker-Analyzed' reagent from J.T. Baker Chemical Co. 100 g of each in 1 liter of hydrochloric acid (2 mol/liter).
Sodium Hydroxide: Certified ACS from Fisher Scientific Co. 300 and 450 g/liter.
Sulfuric Acid: Certified ACS from Fisher Scientific Co. 100 and 450 ml/liter.
Sulfamic Acid: 'Baker-Analyzed' reagent from J.T. Baker Chemical Co.
Triton X-100: 'Baker-Analyzed' reagent from J.T. Baker Chemical Co.
Magnesium Perchlorate: anhydrous granules.

Stock and Working Mercury Standards: A 1000 ppm stock solution of mercuric chloride is prepared by dissolving 0.3384 g $HgCl_2$ in 250 ml 5% H_2SO_4. A 10 ppm intermediate stock solution was prepared by dilution of this stock solution. A working standard of 100 ppb was prepared from this intermediate standard.

PLASTICWARE AND GLASSWARE

All plasticware and glassware used is cleaned by soaking 24 h in detergent, followed by soaking for 3 days in 25% v/v nitric acid. The cleaned items are then rinsed throughly with ultrapure water, and stored in a dust-free environment.

SPECIMEN COLLECTION

The judicious adherance to this protocol ensures urine specimens and samples taken therefrom to be of high quality in terms of minimal contamination from the ambient dust of air/clothes/skin.

1. Instruct subject to wash genitalia and hands prior to voiding and to be either naked or to wear clean underclothes (NO OUTERCLOTHING) when voiding into the collection bottle. A complete body washing (shower) with soap and water is recommended.
2. Collect 100+ mL of a first-morning void urine specimen in a 130 mL collection container (B+D 133 mL containers Cat.#4013 have been satisfactory).
3. Mix specimen thoroughly and decant 10 mL volume into the 15 ml polypropylene centrifuge tubes which have been previously prepared with 20 mg sulfamic acid and 10 ul Triton X-100.
4. Mix specimen thoroughly.
5. Refrigerate collected specimen, and ship refrigerated to laboratory.
6. Prepare a "blank" with 10 mL ultrapure water, treated as described in 3. above. Return to laboratory with acidified urine specimens as a "blank".

OVERALL HELPFUL HINTS AND REMINDERS:

1. Subject must be clean.
2. Handle all materials with clean hands or use plastic gloves.
3. Do not leave caps off containers for any long periods of time and handle caps carefully to avoid contamination of cap's inside.
4. Tighten caps on shipping bottles to prevent leakage.
5. Do not make ink, etc., markings on containers. Use labels.
   PLEASE RETURN ALL CONTAINERS AND OTHER MATERIALS SINCE THE INITIAL COST AND THE TIME EXPENDED FOR CLEANING PROHIBITS REPEATED REPLACEMENTS FOR FUTURE ENDEAVORS.

ANALYTICAL PROCEDURE

Inorganic Mercury

1. Into a 50 ml reaction flask dispense 2 ml of cysteine solution, 4 ml of deionized water, and 10 - 500 microliters of sample (depending on expected concentration), mercury standard, or blank (deionized water).
2. To this flask then add 0.5 ml of the stannous chloride solution and a magnetic stir bar.
3. Connect the flask to the flow-through apparatus which should be open to the absorption tube only and switch on a magnetic stirrer placed under the reaction flask.
4. Pipette 3 ml of the 300 g/liter sodium hydroxide solution into the funnel above the reaction vessel.
5. Open the valve to allow the sodium hydroxide to enter the reaction vessel.
6. When all the sodium hydroxide solution has entered the reaction vessel, close off the reagent valve and the valve between the vessel and the absorption cell.
7. When the reaction nears completion turn on the recorder and zero the pen on the baseline.
8. Allow the reaction to procede for 2 min., then in rapid succession open the valves between the vessel and the absorption cell and between the vessel and the air flow, and redirect the air flow, thus causing the air to sweep through the reaction vessel and into the absorption cell.
9. Record the peak absorbance as the mercury is flushed through the reaction vessel.
10. Continue to flush the system with air until the absorbance reading returns to zero.
11. Switch off the magnetic stirrer and remove the reaction flask from the apparatus.
12. Wash the flask with deionized water, dilute sulfuric acid and more deionized water. The system is now ready for another sample.

Total Mercury

1. Into a 50 ml reaction flask dispense 2 ml of cysteine solution, 4 ml of deionized water, and 10 - 500 microliters of sample (depending on expected concentration), mercury standard, or blank (deionized water) and 1 ml 50% H_2SO_4.
2. To this flask then add 1.0 ml of the $SnCl_2/CdCl_2$ solution and a magnetic stir bar.
3. Proceed as for inorganic Hg, but add 3 ml of 450 g/liter NaOH in step 4 above.

STANDARDIZATION AND CALCULATIONS

Standardization is accomplished by the use of a mercury standard solution. Different aliquots of this 100 ppb working standard solution is added to the reaction flask in order to achieve mercury levels of 2.5, 5.0, and 10.0 ng. Under the conditions employed here absorption values ranging to 60 were achieved with these levels. In all cases the standard curves were linear over this range of values.

Calculations:

Standard curves were analyzed by the method of average slope with absorbance values determined in duplicate. The average of two absorbances of the four aliquots are taken to be:

A = average absorbance of unspiked specimen
B = average absorbance of first spike (+ 2.5 ng)
C = average absorbance of second spike (+ 5.0 ng)
D = average absorbance of third spike (+ 10.0 ng)

Construct the following table:

Added ng	Average Absorbance	Corrected Absorbance	Slope
0	A	-	-
2.5	B	N_1=B-A	N_1/2.5
5.0	C	N_2=C-A	N_2/5.0
10.0	D	N_3=D-A	N_3/10.0

The mean of these values is the average slope for the standard curve. Sample concentrations can be determined using the following equation where A is as defined above.

$$\text{Sample concentration (ng/ml)} = \frac{\text{Absorbance}_{\text{sample}} - A}{\text{Sample volume used (ml)} \times \text{Average slope}}$$

Calculations for both inorganic and total Hg are both carried out in this manner. The level of organic Hg is determined by taking the difference between total and inorganic mercury.

QUALITY CONTROL SYSTEM

Quality Control Statistics

The statistical format used for evaluation of quality control will be that of two way analysis of variance, ANOVA, with the construction of quality control charts based on 95 and 99% confidence limits of the mean of duplicate measurements, as well as range charts (3).

Precision and accuracy of the analytical system will be monitored as follows:

1) Ten analytical runs will be performed to characterize all control materials used, with duplicate measurements performed per run.

2) Analysis of variance calculations will be performed on these twenty data points, and quality control charts will be generated by computer for X and range R.

3) A minimum of two control materials will be incorporated into each analytical run of twenty unknown specimens, and data obtained for these controls will be evaluated with the X and R charts from 2).

The blinds should be identical in appearance to the specimens, with the same containers, specimen volumes, and labelling. If desired, blind quality control specimens can be evaluated with the same statistical methods used for the control materials.

Run Format

In all cases, the following format will be used for specimen determination:

SAMPLE #	Sample ID
1-2	Blanks
3-8 (or greater)	Calibration curve
9-12	Bench quality control materials
13-32	Specimens (including blind controls)
33-34	Blanks
35-36	Calibration sample

Action Limits

The analytical system will be declared "out of control" if one or more of the following events occur (3):

X chart

1) A single X value falls above the upper 99 percent limit or below the lower 99 percent limit.
2) Two successive X values fall either both above the upper 95 percent limit or both below the lower 95 percent limit.
3) Eight X values in succession fall either all above the center line or all below the center line.

R chart

1) A single R value falls above the upper 99 percent limit.
2) Two successive R values fall above the 95 percent upper limit.
3) Eight R values in succession fall above the center line.

If the system should be declared out-of-control, the following remedial action should be taken:

1) Check for errors in recording levels of control samples, and if none are found,
2) Check and calibrate instruments before performing further analyses on analytical samples,
3) Reanalyse patient samples performed during the out-of-control run.

Reference

1. Littlejohn, D., Fell, G.S. and Ottaway, J.M. Modified determination of total and inorganic mercury in urine by cold vapor atomic absorption spectrometry, Clin. Chem. 22 (10): 1719-1723 (1976).

SPECIMEN INFORMATION SYSTEM
FORM 1 - CHARLESTON TENNESSEE MERCURY STUDY
SPECIMEN SHIPPING LIST

Case Number :89-0006

Shipment Number :_____

No. Frozen Shippers:_____
No. Refrigerated Shippers_____

Type* of Specimens : No. Specimens :

Shipped By _____
Name Title

Signature

Date Shipped Phone Number

Received By:_____
Name

of _____
CDC Unit

Signature

Date received

Specimen ID 89-0006 - Person	Type*/Aliquot No. (Mark Shipped Spec.)										Date Collected MM-DD-YY	Comments (Specify any deviation from collection, storage, and shipment protocols, and date of occurrence
89-0006-XXXX	T1	U1	U2	U3	U4							
89-0006												
89-0006												
89-0006												
89-0006												
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89-0006												
89-0006												
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*Type of specimens: T = Urine (preserved), U = Urine (unpreserved), B = Whole Blood

CHARLESTON TENNESSEE MERCURY STUDY
Case 89-0006
Urine Collection and Processing Protocol

Urine Sample (50ml)

Collection Container Labeled
"Urine Container"

Aliquot into
Designated Bottles

T1	U1	U2	U3
15 ml plastic	6 ml plastic	6 ml plastic	6 mL plastic
"Ur. Hg"	"Ur. Creatinine"	"Ur NAGA"	"UR Reserve"
Triton X Sulfamic Acid added at CDC			
Add 10 mL urine	Add 5 mL Urine	Add 5 mL Urine	Add 5 mL urine
Mix by Inverting 5 times			

Freeze immediately at - 20°C

Mail to CDC on dry ice using
of "Federal Express"

Word underlined are labels
Priority of tubes: T_1, U_1, U_2, U_3

Attachment E

PARTICIPANT CONSENT

The Tennessee Department of Health and Environment and the Agency for Toxic Substances and Disease Registry are performing a survey that includes a questionnaire and testing the urine of individuals who are potentially exposed to mercury in their homes due to contamination from workers potentially exposed during a planned maintenance operation at the Olin Chemical Company on August 22, 1988.

Participant: I understand that my (my child's/Ward's) participation will take about thirty minutes. I understand that to test for mercury, it is necessary to obtain a urine specimen consisting of the first void in the morning. (For children who are not potty trained, a pediatric urine collection bag will be provided.) There will be no physical examination. There is no provision for compensation or medical treatment in the event of injury as a result of my participation. I understand that I can stop my or my child's/ward's participation at any time. If I choose not to participate or to stop at any time there will be no penalty. Any benefits which I now receive or to which I am entitled will not be affected by this decision.

I agree to allow urine testing for exposure to mercury to be performed on:

(__) myself
(__) my child/ward, _____

As a result of my/my child/ward's participation in this survey, I/my child/ward will receive a urine test for mercury at no charge. I will receive the results of this test within eight to twelve weeks. Along with my test results will be some interpretation or explanation of the results.

Confidentiality: I understand that data collected will be safeguarded in accordance with applicable statutes. Any reports of this survey will not identify specific individuals, and will only give group information.

Participant Consent: I have read the description of this Health Survey. All of my questions have been satisfactorily answered. I voluntarily request that I (my child/ward) be included in this survey.

Participant/guardian name (print) _____

Participant/guardian signature _____

Date _____ Witness: _____

Assent by the minor child aged 6 years or older:

We are doing a survey and would like you to give us some urine in a specimen cup. This is to see if you have some chemicals in you.

I agree with the consent given by my parent/guardian.

Check, initial, or signature of minor _____
Date _____

If you want your test results sent to your private physician, please list the name and mailing address below.

Attachment F

Mercury Exposure Study
Charlestown, Tennnesee
December 7 - 10, 1988

Individual Laboratory Report

Name _____

Date of Birth _____

	Level	Normal	See Below
Urine mercury (ug/L)	_____	_____	_____
Urine mercury/creatinine (ug/g)	_____	_____	_____

Recommendation

A. Urine mercury equal or less than 20 ug/L:

No health recommendation. Levels below 20 ug/L are typical of the United States population and are considered normal.

B. Urine mercury greater than 20 ug/L to 100 ug/L:

This level indicates exposure to mercury. No adverse health affects are expected at these low levels. The World Health Organization feels that central nervous system toxicity in adults does not occur at levels below 50 ug/L.

C. Urine mercury greater than 100 ug/L:

Non-specific neurological symptoms may begin to appear at mercury levels greater than 100 ug/L. These symptoms may include numbness, difficulty in walking, difficulty in talking, and deafness. Changes in behavior, such as increased aggression, may also occur. We recommend that you consult your physician.

10 11 0001

Site:
Break: 10.11
Other:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV

IN THE MATTER OF:	)	
	)	
Olin Mercury Spill	)	
Charleston, Tennessee	)	
	)	
Olin Corporation	)	
Lower River Road	)	Docket
No.88-34-C		
Charleston, Tennessee 37310	)	

ADMINISTRATIVE ORDER

The following Order is issued on this date to the Olin Corporation, "Respondent", Lower River Road, Charleston, Tennessee, 37310, pursuant to Section 106(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 U.S.C. Section 9606(a), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), P.L. 99-499, by authority delegated to the undersigned by the Administrator of the United States Environmental Protection Agency (EPA). Notice of the issuance of this Order has heretofore been given to the State of Tennessee.

There is an imminent and substantial endangerment to the public health and welfare and the environment due to a release or the threat of a release of a hazardous substance as defined in Section 101(14) of CERCLA (42 U.S.C. Section 9601 (14)), from the following location:

Olin Corporation's chlor-alkali facility
Lower River Road
Charleston, Tennessee 37310

This Order directs you to undertake action to protect the public and the environment from this endangerment.

FINDINGS OF FACT

1. Respondent is the current owner and operator of property located on Lower River Road in Charleston, Tennessee. Respondent utilizes this property as a chlorine production facility utilizing the mercury-cell electrochemical process. As a result of this process, Olin produces mercury bearing wastes. This property is hereinafter referred to as the "facility".

2. Olin Corporation owned and operated this facility on August 22, 1988, at which time the Yeargin Construction Company was contracted to replace cell header pipes in cell building 812 of the facility.

3. According to Yeargin employees involved in the operation, a substantial quantity of mercury was pooled on the floor of cell building 812, and was contained in the building by a sand dike. Olin safety personnel indicated to the Yeargin employees that only rubber boots and tyvek were necessary for the work in cell building 812; respiratory protection was not required. As the construction workers began to remove the cell header pipes using oxygen/acetylene torches, mercury vapor and elemental mercury flowed out of the pipes. Air monitoring was not conducted by the Olin personnel during the work activities.

4. Yeargin employees worked from about 0730 to 2400 hours on August 22, 1988 under these conditions. Upon completion of their work, the Yeargin employees were either denied use of the Olin personnel hygiene/decon facility, or they failed to avail themselves of such facilities. Each Yeargin employee left the Olin Plant after working in cell building 812, and proceeded via personal transportation.

5. Several of the Yeargin employees had to leave work early because of illness. Upon departure from the facility, several more of the Yeargin employees also became ill on their trip home.

6. On October 24, 1988, a Yeargin Company employee, notified EPA of the incident. According to the employee, he and numerous employees were exposed to the mercury during their work at Olin on August 22, 1988.

7. The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) have recommended that workplace concentrations of mercury should not exceed 50.0 ug/m^3 over an 8-hour period. This limit is not appropriate to a residential situation because: (1) occupational exposure applies to an 8-hour day and a 5-day week; in the homes, exposures may occur 24 hours a day and 7 days a week; and (2) the occupational exposure recommendations apply only to healthy workers; this exposure may not be protective of sensitive segments of the population. In the 1986 Superfund Public Health Evaluation Manual, the EPA recommended that chronic exposure to mercury in air should not exceed a concentration of 0.18 ug/m^3; however, since the confident detection limit for mercury is 0.5 ug/m^3, this is considered as the chronic exposure limit from ATSDR.

8. From November 1-4, 1988, an air monitoring survey was conducted by EPA's Environmental Services Division (ESD) and a representative of the Agency for Toxic Substances and Disease Registry (ATSDR). A total of six homes were randomly selected and monitored for air quality. Instantaneous results inside the homes showed mercury levels from non-detectable to 53.8 ug/m^3. Monitoring using eight hour continuous dosimeter tubes showed levels inside the homes from 1.0 to 5.0 ug/m^3. In addition, mercury was detected inside many of the worker's vehicles in excess of the exposure limit. Additional sampling conducted by EPA from December 5 to December 13, 1988, revealed an additional 17 homes that exceeded the exposure limit.

CONCLUSIONS OF LAW

1. Cell building 812 of the Olin plant at Charleston, Tennessee constitutes a facility within the meaning of Section 101(9) of CERCLA, 42 U.S.C. Section 9601(9).

2. Respondent is the owner of the facility within the meaning of Section 101(20) of CERCLA, 42 U.S.C. Section 9601(20).

3. Respondent is also the operator of the facility and controlled and managed the activities at the facility within the meaning of Section 101(20) of CERCLA, 42 U.S.C. Section 9601(20).

4. Mercury is a hazardous substance within the meaning of Section 101(14) of CERCLA, 42 U.S.C. Section 9601(14).

5. The hazardous substance described above was stored and handled in such a manner that there was an actual release and a threat of a release of a hazardous substance into the environment within the meaning of Sections 101(22) and 106(a) of CERCLA, 42 U.S.C. Section 9601(22) and 9606(a).

DETERMINATIONS BY REGIONAL ADMINISTRATOR

Based on the Foregoing Findings of Fact and Conclusions of Law, and the entire record of this proceeding, the Regional Administrator has determined that:

1. The release and threat of a release of hazardous substances from the facility presents an imminent and substantial endangerment to the public health and welfare and the environment;

2. In order to protect public health or welfare or the environment, it is necessary that action be taken to mitigate the release into the environment; and

3. The actions required in this Order are consistent with the National Contingency Plan, 40 C.F.R. Part 300.65.

ORDER

Based upon the foregoing determinations and findings of fact, the Respondent is hereby ordered and directed to undertake the following activities pursuant to Section 106(a) of CERCLA, 42 U.S.C. Section 9606(a):

1. Remove, treat and/or dispose of the following at a federally approved hazardous waste facility:

   All hazardous substances and contaminated material and/or residue located on Olin property; and homes, the contents therein and vehicles of Olin/Yeargin employees who were exposed in cell building 812, in the August 22, 1988, mercury release incident.

2. Provide adequate verification and documentation that all hazardous substances are removed, treated, and/or disposed of at federally approved facilities.

3. All actions carried out by the Respondent pursuant to this Order shall be performed in accordance with all applicable federal, state, and local laws.

4. Respondent shall assure access to the site by EPA, its authorized representatives, contractors and consultants for purposes of implementation of this Order.

5. All response work performed pursuant to this Order shall be under the direction and supervision of a qualified engineer or manager with expertise and experience in hazardous waste site cleanup. Respondent shall notify EPA as to the identity of such engineer, contractors, or subcontractors to be used in carrying out the terms of this Order in advance of their work at the site.

6. Respondent shall use quality assurance, quality control, chain-of-custody and manifest procedures in accordance with the EPA guidance throughout all activities. Respondent shall consult with EPA prior to planning for sampling, analysis, transportation and disposal. Respondent shall provide a quality control report to EPA which certifies that all activities have been performed as approved by EPA.

7. Respondent shall preserve and retain all records developed pursuant to implementation of this Order for a period of at least six (6) years following completion of all work conducted by Respondent pursuant to this Order.

8. Nothing herein shall constitute or be construed as a satisfaction or release from liability for any conditions or claims arising as a result of past operations or ownership of the site by the Respondent, its agents, contractors, lessees, successors or assigns.

9. Respondent shall take actions that are necessary to protect the public health, welfare, and the environment. The Respondent shall report to the EPA On-Scene Coordinator (OSC) prior to taking any such action. Such actions shall include but are not limited to decontamination of all homes presently known to contain mercury in the normal breathing zone and "hotspots" areas to levels deemed acceptable to EPA/ATSDR; sampling the home environment of all Olin/Yeargin workers involved in the August spill; cleanup of all such homes found to have elevated mercury levels; assurance that the Olin/Yeargin workers and family members receive appropriate medical testing and followup for mercury exposure; and provision of temporary housing for all families whose homes require extensive decontamination. For those homes that cannot be decontaminated to an acceptable level to EPA/ATSDR, permanent relocation may be required.

10. Notwithstanding compliance with the terms of this Order, the Respondent may be required to take further actions as necessary to abate any endangerment posed by conditions at the site.

11. In the event that the OSC determines that activities implemented are not in compliance with this Order, or any other circumstances or activities are creating an imminent and substantial endangerment to the public health or welfare or the environment, the Regional Administrator of EPA, Region IV, may order the Respondent to cease actions at the site and EPA will carry out the activities pursuant to this Order.

12. Neither the United States nor any agency thereof shall be liable for any injuries or damages to persons or property resulting from acts or omissions of Respondent, his officers, directors, employees, agents, servants, receivers, trustees, successors, or assignees, or any person, including but not limited to firms, corporations, for any activities pursuant to this Order, nor shall the United States or any agency thereof be held as a party to any contract entered into by the Respondent in carrying out activities pursuant to this Order.

13. Respondent shall:

a. Develop a site safety plan subject to approval by EPA.

b. Develop a work plan for EPA approval within twenty (20) days after the effective date of this Order.

c. Begin implementation of the work plan within ten (10) days of its approval. Respondent must notify the OSC two working (2) days prior to the initiation of <u>any</u> on-site activity.

d. Complete all activities within one hundred eighty (180) days of initiation of on-site activities.

14. This Order is effective upon receipt, notwithstanding any conferences requested by the Respondent. All times for performance of response activities shall be calculated from that date.

NOTIFICATION OF INTENTION

You must notify EPA in writing within five (5) days after receipt of this Order whether you intend to comply with the terms of this Order.

OPPORTUNITY FOR CONFERENCE

If Respondent wishes to confer with EPA to discuss this Order, its applicability to Respondent, or the correctness of any factual matters with respect to those actions required above or cleanup plans and scheduling, a request must be made by telephone with written follow-up within three (3) days after receipt of this Order. Respondent may appear in person or may be represented by an attorney or other representative at any conference held at his request. Any request for a conference should be made to:

Mr. James Kopotic
On-Scene Coordinator
Waste Management Division
U.S. Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365
404/347-3931

OR

Mr. Rueben Bussey
Assistant Regional Counsel
U.S. Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365
404/347-2641

VIOLATIONS OF ORDER

Violation by the Respondent of this Order through failure to comply with any provision herein or otherwise shall be enforceable pursuant to Sections 106(b) and 113(b) of CERCLA, 42 U.S.C. Sections 9606(b) and 9613(b). Failure to comply may also subject Respondent to civil penalties of up to $25,000 per day and/or punitive damages in an amount three times the costs incurred by the United States as a result of such failure, as provided in Section 106(b) and 107(c)(3). Nothing herein shall preclude EPA from taking such other actions as may be necessary to protect the public health and welfare or the environment and recovering the costs thereof.

By:_____

Greer C. Tidwell
Regional Administrator

Dated this _____ day of December, 1988.

10 11 0008

Break: 10.11
Other:

Olin CHEMICALS

P.O. BOX 248, CHARLESTON, TN 37310
(615) 336-4000

January 10, 1989

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Greer C. Tidwell
Regional Administrator
United States Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

Re: Olin Mercury Spill, Charleston, TN

Dear Mr. Tidwell:

This letter acknowledges receipt of Administrative Order No. 88-34-C on January 6, 1989. The purpose of this letter is to respond within five (5) calendar days pursuant to the Administrative Order.

Olin Corporation intends to comply with the Administrative Order. However, Olin Corporation denies that it is liable under CERCLA, 42 U.S.C. 9601, et seq., and reserves all of its rights thereunder.

We will proceed forward with paragraph 13 of the Administrative Order wherein we will develop the required work plan.

In order for us to respond to this matter and implement the Administrative Order, we request that we immediately receive a list of the homes referenced in the Administrative Order, results of all agency sampling, and the results of all biological monitoring (including urinalysis) of persons occupying the referenced homes.

Olin Corporation shortly will respond formally in writing to the Administrative Order. Olin Corporation notes a number of terms or provisions which are unclear, misleading, inaccurate, overly broad, and otherwise inappropriate, and we shall respond in writing as indicated.

Sincerely,

Maurice Davenport

Maurice Davenport
Plant Manager
OLIN CORPORATION
Lower River Road
Charleston, TN 37310

MSD/8905/bap

United States Environmental Protection Agency
Region 4
Office of Public Affairs
345 Courtland Street, NE
Atlanta, GA 30365
Alabama
Florida
Georgia
Kentucky
Mississippi
North Carolina
South Carolina
Tennessee

13 7 0010

EPA Environmental News

(404) 347-3004

Site:
Break: 13.7
Other:

CLEANUP OF MERCURY CONTAMINATED HOMES BEGINS MARCH 20 IN CHARLESTON, TN

The U. S. Environmental Protection Agency announced today that the Olin Corporation will begin a cleanup of 25 mercury contaminated homes this week in Charleston, Tennessee.

The contamination occurred on August 22, 1988 when employees of the Yeargin Construction Company, hired by Olin to replace cell header pipes at the Olin facility in Charleston, were exposed to mercury in cell building 812 during the operation. When the workers left the facility following the exposure, their homes were subsequently contaminated. [illegible] in [illegible] of the workers' homes revealed 25 of the homes had mercury levels in excess of 0.5 ug/m^3 (micrograms per cubic meter), a chronic exposure limit recommended by the Agency for Toxic Substances and Disease Registry (ATSDR) to prevent health effects from long-term exposure.

The cleanup is being conducted under the terms of an Administrative Order issued by EPA to the Olin Corporation in January 1989. EPA is requiring Olin to remove, treat and/or dispose of the following at a federally approved hazardous waste facility:

- All hazardous substances and contaminated material and/or residue located on Olin property; and homes, the contents therein and vehicles of Olin/Yeargin employees who were exposed in cell building 812, in the August 22, 1988, mercury release incident.

The cleanup is expected to be completed within six ~~months~~ weeks.

March 20, 1988

CONTACT: Charlis Thompson, Region IV EPA (404) 347-3004

EPA 450/3-84-014

17 7 0001

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-450/3-84-014
December 1984

Air

EPA

Review of National Emission Standards for Mercury

Site:
Break: 17.7
Other:

Library Region IV
US Environmental Protection Agency
345 Courtland Street
Atlanta, Georgia 30365

3. MERCURY-CELL CHLOR-ALKALI PROCESS

3.1 INTRODUCTION

Three types of electrolytic cells are used in the U.S. to produce chlorine and caustic: the mercury cell, the diaphragm cell, and the membrane cell. Mercury is emitted to the atmosphere only from the mercury-cell process.

There are 32 chlorine producing companies, with 60 chlor-alkali plants, in the U.S. Mercury-cell technology is used at 24 plants, diaphragm-cell technology is used at 34 plants, and membrane-cell technolog is used at two plants.[1] Mercury-cell chlor-alkali plants in the U.S. are listed in Table 3-1 along with the year built and type of cells used at each plant.

Average chlorine production by all processes increased only slightly from 25,855 Mg/d (28,500 tons/d) in 1973 to 26,243 Mg/d (28,928 tons/d) in 1981.[2] Total installed chlorine capacity increased from 26,892 Mg/d (29,643 tons/d) in 1973 to 35,835 Mg/d (39,502 tons/d) in 1981.[2] The percent of total installed chlorine capacity using mercury cells decreased from 25 percent in 1973 to 19 percent in 1982.[3] The chlor-alkali industry used 6,516 flasks (225 Mg [248 tons]) of mercury in 1982.

It is probable that no new mercury-cell chlor-alkali plants will be built in the U.S. in the future.[4] No new plants have been built since the national emission standard was promulgated in 1973. There has been some new construction in the chlor-alkali industry but not in the mercury-cell segment. In the future, membrane-cell technology may take precedence over both the mercury-cell and diaphragm-cell technologies.[4]

TABLE 3-1. MERCURY-CELL CHLOR-ALKALI PLANTS IN THE UNITED STATES[5]

Company/location	Year built	Cell type
Convent Chemical Company[a] (Subsidary of B. F. Goodrich) Calvert City, Ky.	1966	De Nora 24H5
Diamond Shamrock Corp.,		
Deer Park, Tex.[a]	1938	De Nora 18 SGL; (also diaphragm cell)
Delaware City, Del.[b]	1965	De Nora 18x4
Mobile, Ala.[a]	1964	De Nora 18x4
Muscle Shoals, Ala.[b]	1952	De Nora 24x2M
Georgia Pacific Company[a,c] Bellingham, Wash.	1965	De Nora 18x4
Linden Chemicals & Plastics, Inc.		
Acme, N.C.[a]	1963	Solvay V-200
Ashtabula, Ohio[d]	1963	Olin E11F
Brunswick, Ga.[a]	1957	Solvay V-100
Linden, N.J.[a]	1956	BASF-Krebs (1969); Krebs (1963)
Moundsville, W. Va.[a]	1953	Solvay S60
Orrington, Maine[a]	1967	De Nora 24H5
Syracuse, N.Y.[a]	1927	Solvay S60 (1953); (also diaphragm cell)
Monsanto Company[b] Sauget, Ill.	1922	De Nora 18x6
Occidental Chemical[d] Corporation/IMC Corporation (Hooker-Sobin Joint Venture) Niagara Falls, N.Y.	1971	Uhde 20 sq. m
Olin Corporation		
Augusta, Ga.[a]	1965	Olin E11F
Charleston, Tenn.[a]	1962	Olin E11F, E812
McIntosh, Ala.[a]	1952	Olin E8
Niagara Falls, N.Y.[a]	1897	Olin E11F (1960)
PPG Industries, Inc.		
Lake Charles, La.[a]	1947	De Nora 48H5 (1969); (also diaphragm cell)
New Martinsville, W. Va.[a]	1943	Uhde 20 sq. m (1958); (also diaphragm cell)
Stauffer Chemical Company		
LeMoyne, Ala.[a]	1965	De Nora 22x5
St. Gabriel, La.[a]	1970	Uhde 30 sq. m
Vulcan Materials Company, Chemicals Division[a] Port Edwards, Wis.	1967	De Nora 24H5

[a]Electrolytic plant producing caustic soda, chlorine, and hydrogen from brine.
[b]Electrolytic plant producing caustic soda, caustic potash, chlorine, and hydrogen from brine.
[c]Pulp mill.
[d]Electrolytic plant producing caustic potash, chlorine, and hydrogen from brine.

3.2 PROCESS DESCRIPTION

3.2.1 Mercury-Cell Process

A flow diagram for the production of chlorine and caustic using mercury cells is given in Figure 3-1. Purified brine is fed from the main brine treatment section through the inlet end box to the electrolyzer, where it flows between a stationary graphite or metal anode and a flowing mercury cathode. The spent brine is recycled from the electrolyzer to the main brine treatment section through a dechlorination step. Chlorine gas is formed at the anode of the electrolyzer and is collected for further treatment. The gas is cooled, dried by scrubbing with concentratec sulfuric acid, and compressed. The dry chlorine gas may be used directly or may be liquified.[6]

The sodium is collected at the cathode of the electrolyzer, forming an amalgam. The sodium amalgam flows from the electrolyzer through the outlet end box to the decomposer, where it is the anode to a short-circuite grap ite or metal cathode in an electrolyte of sodium hydroxide solution. Water is fed to the decomposer and reacts with the sodium amalgam to produce elemental mercury, sodium hydroxide solution, and by-product hydrogen gas.

The stripped mercury is returned to the cell. The caustic soda solution generally leaves the decomposer at a concentration of 50 percent sodium hydroxide by weight. This solution is usually filtered to remove impurities. The filtered caustic solution may be further concentrated by evaporation. The by-product hydrogen gas from the decomposer may be vented to the atmosphere, burned as a fuel, or used as a feed material in other processes.[6]

The inlet end box is a receptacle that is placed on the inlet end of the electroylzer to provide a convenient connection for the stripped mercury as it returns from the decomposer to the electrolyzer. Also, it keeps the incoming mercury covered with an aqueous layer. The outlet end box is a receptacle that is placed on the outlet of the electrolyzer to provide a convenient means for keeping the sodium amalgam covered with an aqueous layer and for the removal of thick mercury "butter" that is formed by impurities.[6,7]

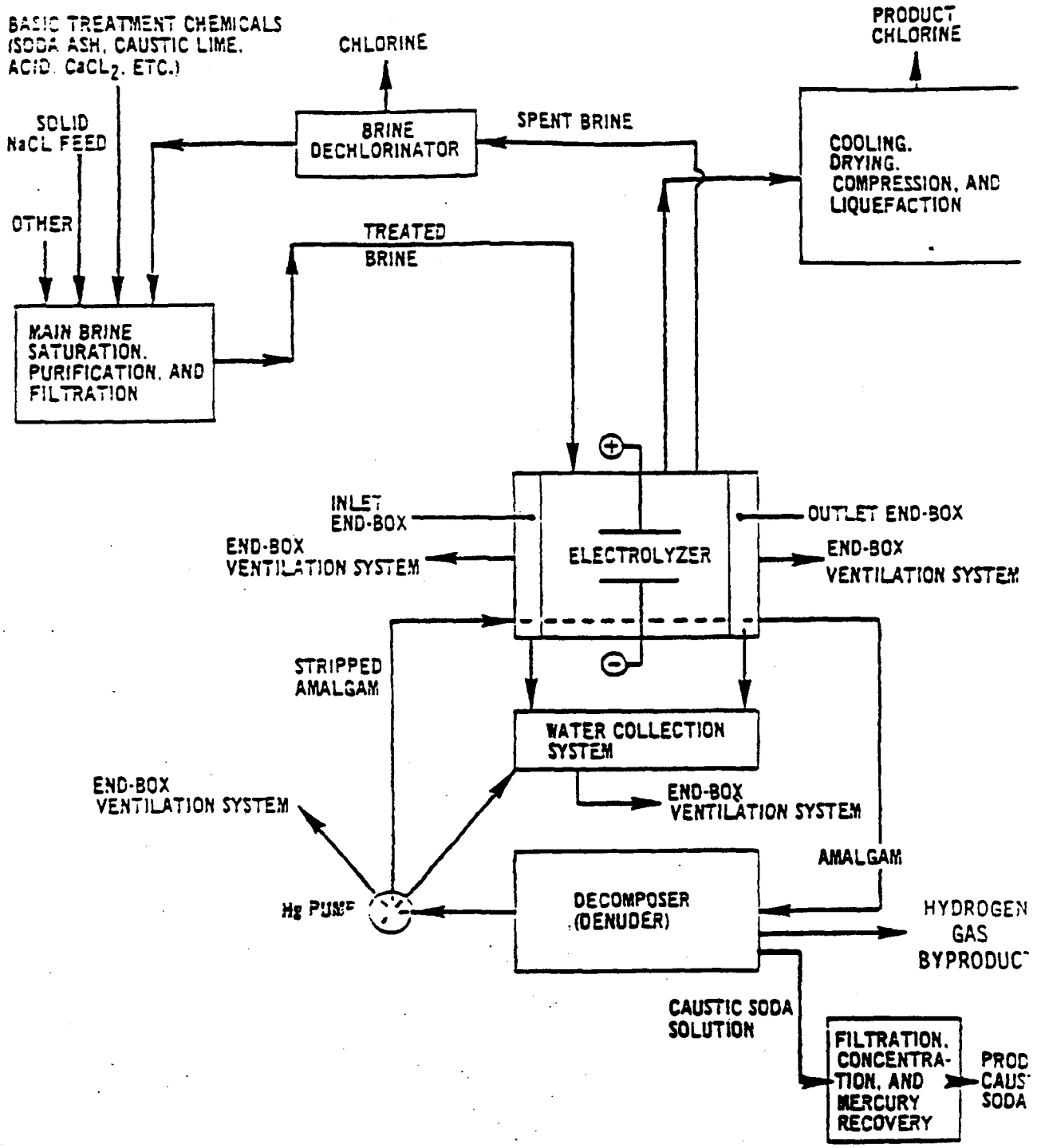


Figure 3-1 Basic flow diagram for mercury-cell chlor-alkali operation.[8]

The end-box ventilation system applies suction to the end boxes, the sumps for the mercury pumps, and the water collection system to reduce mercury vapor emissions to the cell room. A large quantity of ventilation air is used to keep the mercury vapor concentration of the cell room at allowable levels.[6] Typical volumes for cell room ventilation air range from 94 to 425 standard m^3/s (200,000 to 900,000 scfm).[9]

Several chlor-alkali companies recover mercury from sludges by using retorts on-site. Sludges are loaded into the retort and indirectly heated to high temperature to vaporize the mercury. The mercury vapor is cooled in a water-cooled condenser outside the retort and is recovered. Mercury recovery retorts are typically operated on an intermittent basis, one to several times per month.[10,11] Secondary recovery of mercury is discussed further in Chapter 6.

3.2.2 Mercury Emission Sources

The major sources of mercury emissions to the atmosphere are: (1) the hydrogen by-product stream, (2) end-box ventilation system, and (3) cell room ventilation air. The hydrogen by-product stream leaving the decomposer is saturated with mercury vapor and may carry mercury in the form of fine droplets. The amount of mercury emitted by the end-box ventilation system depends on the degree of mercury saturation and the volumetric flow rate.

Mercury enters the cell room air from a number of sources, which include: (1) end-box sampling, (2) removal of mercury butter from end boxes, (2) cell maintenance and rebuilding operations, (4) other maintenance work that exposes internal surfaces of pipes and equipment, (5) accidental mercury spills, (6) leaks from cells and mercury pumps, and (7) cell failure and other unusual circumstances.[12]

3.3 CONTROL TECHNOLOGY

Control techniques used to reduce mercury emissions from the hydrogen stream and end-box ventilation stream are: (1) cooling, (2) mist elimination, (3) chemical absorption, (4) activated carbon adsorption, and (5) molecular sieve adsorption. These are described briefly in this section. For more detailed descriptions, see References 13 and 14. Also discussed in this section are housekeeping practices for the cell room and the use of nonmercury cell technology.

No new control technology has been developed in the chlor-alkali industry since the national emission standard was promulgated in 1973.[9]

3.3.1 Cooling

Cooling may be used as the primary control technique for the hydrogen stream or the end-box stream, or it may precede other control techniques. Hydrogen leaves the decomposer at 93° to 127°C (200° to 260°F) and passes into a primary cooler. Water at ambient temperature is typically used in a shell-and-tube heat exchanger to cool the stream to 32° to 43°C (90° to 110°F). A mercury knockout drum following the cooler separates the condensed mercury from the hydrogen stream. An additional direct or indirect cooler using chilled water or brine may further cool the hydrogen stream to 3° to 13°C (37° to 55°F). Direct-contact coolers using chilled water or brine require water treatment systems.

The end-box ventilation air can be cooled similarly to the hydrogen stream. Direct-contact coolers are used more than indirect coolers due to the presence of mercuric chloride particulate matter in the gas stream.

3.3.2 Mist Elimination

The cooled gas stream is typically passed through a mist eliminator. Two basic types of mist eliminators remove mercury mist from gas streams. One consists of a fiber pad enclosed in screens, and the other uses a converging-diverging nozzle. Trapped particles are removed from the mist eliminators by spray washing.

3.3.3 Chemical Absorption

Scrubbers using depleted brine or a sodium hypochlorite (NaOCl) solution have been used for mercury removal from hydrogen and end-box ventilation gas streams. In the depleted brine scrubbing system, the spent brine discharged from the cell is used as the scrubbing medium in a sieve plate tower or a packed-bed scrubber. Mercury vapor and mist form soluble mercury complexes upon contact with the scrubbing solution. The scrubbing solution is returned to the mercury chlor-alkali cell where the mercury is recovered by electrolysis.

3.3.4 Activated Carbon Adsorption

Sulfur- and iodine-impregnated carbon adsorption have been used by several companies to reduce the mercury concentration in the hydrogen

gas stream. Prior to carbon adsorption, primary and secondary cooling followed by mist elimination have usually removed about 90 percent of the mercury content of the hydrogen stream.[15] The mercury vapor remaining in the stream is adsorbed by the carbon and chemically reacts with the sulfur or iodine to form mercury compounds. Several adsorber beds may be placed in series. A vendor has reported typical outlet concentrations below 50 parts per billion by volume (ppbv) that may approach 1 ppbv.[16]

3.3.5 Molecular Sieve Adsorption

Mercury vapor can be removed from the hydrogen gas stream or end-box ventilation stream by adsorption on a proprietary molecular sieve adsorbent.[9] The PuraSiv-Hg® system developed by Union Carbide Corporation is used by five chlor-alkali companies in the U.S.[9] Following cooling and mist elimination, the hydrogen gas stream passes through one of two adsorption beds. Eighty to ninety percent of the treated hydrogen gas passes out of the system to disposal or usage. The remainder is heated to 316°C (600°F) and used as a recycle-regeneration stream for removing entrapped mercury from the second adsorber bed. After passing through the second adsorption bed, this gas stream is cooled and is combined with the incoming mercury-laden hydrogen stream from the primary cooling section. At any time, one bed is undergoing adsorption, and the other is undergoing regeneration. The concentration of mercury in the effluent has been guaranteed to be lower than 60 ppbv on average.[17] Some operational problems have been reported with molecular sieves currently in operation. The most common difficulties involved excessive moisture buildup; however, to date all problems have been corrected.[9]

Union Carbide no longer supplies the PuraSiv-Hg® process to control mercury emissions from chlor-alkali plants. However, Union Carbide could provide a license to its patents and technology.[18]

3.3.6 Housekeeping Practices

The mercury national emission standard allows chlor-alkali companies the option of either modifying the cell room so stack sampling can be used or complying with approved maintenance and housekeeping practices that will minimize mercury emissions from the cell room. All chlor-alkali companies have opted to follow the EPA recommended housekeeping practices in lieu of stack testing. An emission limit of 1,300 g/d (2.8 lb/d) of

total mercury is assigned to the cell room when the housekeeping practices are followed. The housekeeping practices recommended by the EPA are listed in Appendix A of this document.[19]

3.3.7 Nonmercury-Cell Technology

Mercury emissions from chlor-alkali operations can be eliminated by switching to a nonmercury technology, either the diaphragm- or membrane-cell technology. In the diaphragm cell, the electrolytic reaction products are separated by an asbestos diaphragm. Chlorine is generated at the anode on one side of the diaphragm, and caustic soda and hydrogen gas are produced at the cathode on the other side. Several disadvantages of the diaphragm-cell process preclude it from being a universal substitute for the mercury-cell process. A lower grade caustic (i.e., greater sodium chloride content) is produced by the diaphragm-cell process, and the caustic at about 11 percent by weight must be evaporated to obtain a 50 percent solution.[20] A second disadvantage is that diaphragm-cell plants may discharge asbestos in their wastewater streams.

The membrane cell process is free from both mercury and asbestos contaminants. In the membrane cell, a synthetic cation exchange membrane separates the electrolytic reaction products. As in the standard diaphragm cell, chlorine gas is generated at the anode on one side of the membrane, and caustic soda and hydrogen gas are produced at the cathode on the other side. The membrane allows passage of only sodium ions from the anode to cathode compartment. This results in production of caustic that is purer and more concentrated than that from standard diaphragm cells.[21] The caustic solution produced by membrane cells can be up to 25 to 30 percent caustic by weight.[22] This caustic solution must also be evaporated to obtain a 50 percent solution.

Japan is presently committed to convert all mercury-cell chlor-alkali operations to membrane-cell operations. In 1979, Japanese government committees judged that membrane-cell technology had reached a technical level suitable for commercial application.[23,24] There are presently two commercial and two pilot chlor-alkali plants employing membrane cells operating in the U.S.[25,26]

Most chlor-alkali companies employing mercury-cell technology have considered using the membrane-cell technology. However, the current

economic conditions of the chlor-alkali industry and the cost of switching to membrane cells are a major impediment to replacement at this time.[27]

3.4 WASTE DISPOSAL

Because of its vaporization properties, mercury can be emitted to the atmosphere from mercury contaminated waste products. Techniques used to remove mercury from wastewater and solid waste products are discussed below.

3.4.1 Wastewater

Potential sources of mercury-laden wastewater discharges at a mercury-cell chlor-alkali plant include: (1) cell room floor washing, (2) caustic filter backwash, (3) cell end-box washing, (4) brine purges and filter washing, (5) mercury pump seal water, and (6) direct-contact cooling of the hydrogen stream.[9]

Wastewater is typically treated at a central treatment plant located on-site. A commonly used treatment method is precipitation with sodium sulfide or sodium hydrosulfide followed by filtration.

Mercury-cell chlor-alkali plants are subject to effluent limitations guidelines and new source performance standards for the mercury content of wastewater effluents.[27]

3.4.2 Solid Waste

Potential sources of mercury-contaminated solid waste at a chlor-alkal plant include: (1) wastewater treatment solids, (2) mercury-contaminated equipment, (3) brine purification solids, (4) caustic filter backwash, (5) spent carbon from carbon bed adsorbers, and (6) retort ash.[9] Mercury may be recovered from certain sludges in retorts as described previously. Sludges and solid wastes generated in the process are typically disposed in a hazardous waste landfill.

3.5 COMPLIANCE TEST RESULTS

All operating chlor-alkali plants are in compliance with the national emission standard for mercury according to the EPA Compliance Data System and EPA regional and State contacts.[28] Following the promulgation of the standard, all plants were required to demonstrate compliance.

Test results for the hydrogen gas stream and the end-box ventilation system are given in Table 3-2. Mercury emissions from the hydrogen gas

stream ranged from 1 to 891 g/d (0.002 to 2.0 lb/d).[9] The lower mercury emission levels were generally measured on hydrogen streams controlled by molecular sieve or carbon adsorption control systems.[9] (Performance problems encountered with these and other control devices are discussed in the next section.) Most mercury emission levels above 400 g/d (0.88 lb/ were measured on hydrogen streams controlled by cooling systems alone.[9] For the end-box ventilation stream, mercury emissions generally ranged from 1 to 428 g/d (0.002 to 0.94 lb/d).[9] Test methods used followed EPA Method 101 for the end-box ventilation streams and Method 102 for hydrogen streams. No data are available for cell room emissions because all mercury-cell chlor-alkali companies have opted to follow the EPA cell room housekeeping practices instead of testing cell room emissions.[9]

3.6 COMPLIANCE AND ENFORCEMENT ASPECTS

3.6.1 Compliance Problems

Compliance problems noted by several companies include cell room floor maintenance, training of operation and maintenance personnel, and control system failures. The most common control system failures occur in the hydrogen cooling systems. Duplicate systems are usually installed as backups to correct this problem.[9] These backup systems have become increasingly important in plants where molecular sieves are used. This is due to regeneration problems that arise in the molecular sieves when the primary hydrogen coolers are fouled or fail. No other control problems were reported by industry.[9]

Information on mercury-cell chlor-alkali plants was obtained from States, EPA regions, and information requests to the industry. Each contact was asked to express his or her views on the appropriateness of the current standard. Two companies noted that the standard is reasonable and should not be changed.[29,30] No chlor-alkali company suggested any changes to the mercury emission level or to the EPA test methods. One company noted that the cell room floor maintenance, and housekeeping practices are achievable, and EPA's figure of 1.300 g/d (2.9 lb/d) of mercury emissions assumed for the cell room when these practices are followed is reasonable.[31] The EPA design, maintenance, and housekeeping practices for the cell room are listed in Appendix A. One company had the following comments on the [illegible] for the cell room:[30]

TABLE 3-2. COMPLIANCE TEST RESULTS FOR MERCURY EMISSIONS FROM HYDROGEN STREAMS AND END-BOX VENTILATION STREAMS AT MERCURY-CELL CHLOR-ALKALI PLANTS[a]

Cl_2 production rate, tons/d	Control devices[c]		Date of test	Total Hg[b] emissions			
				H_2		End-box	
	H_2	End-box		g/d	lb/d	g/d	lb/d
350	HE, KO, CP, SP, HE, ME, HE, CB	S, D, B	1974	109	0.24	246	0.54
			1979	6	0.01	160	0.35
300	CO, D, CP, CB	CO, CP, CH, D	1974	1	0.002	NA	NA
120	CO, CP, CP SP, CH	None	1974	145	0.32	NA	NA
			1977	0.25	0.001	NA	NA
			1978	0.41	0.001	NA	NA
			1980	162	0.36	NA	NA
			1980	90	0.20	NA	NA
			1981	6	0.01	NA	NA
			1982	9	0.02	NA	NA
400	CO, CP, CH KO, CB	None	1979	7	0.02	NA	NA
			1980	3	0.01	NA	NA
235	CO, CO, CO, D	CO, CO, D	1981	354	0.78	1	0.003
110	CO, ME, CP	BS	1977	239	0.52	48	0.11
			1981	88	0.19	16	0.04
	CO, CP, CH, D	NA	1973	420	0.93	165	0.36
			1974	322	0.71	114	0.25
			1977	163	0.36	23	0.05
450	CO, CP, MS	S, S	1975	7	0.02	1	0.002
			1976	94	0.21	<4	<0.01
			1976	57	0.13	NA	NA
225	CO, R	S, S	1973	434	0.96	201	0.44
220	CO, SP, B, CO, D, MS	CO, SP, B, MS	1974	47	0.10	NA	NA
			1979	10	0.02	NA	NA
100	SP, CO, CH, DR, CB	S	1980	157	0.35	550	1.21
135	CO, CO, S, CB	CO	1973	NA	NA	16	0.036
125	CO, CO, CP, CP, CP, CP, CP, CO, CO,	S, CO	1974	50	0.11	428	0.94
321	CH, CH, MS	CH, D	1982	295	0.65	235	0.52
	[illegible]	[illegible]	1982	48	0.11	390	0.86
[illegible]	[illegible] CO, F, CO, CO	CO	1981	592	1.31	236	0.52
700	CO, D, MS, CP, CB	CO, SP, B	1975	264	0.58	44	0.10
	[illegible]	[illegible]	1973	NA	NA	90	0.20

TABLE 3-2. (continued)

Plant code[a]	Cl_2 production rate, tons/d	Control devices[c]		Date of test	Total Hg[b] emissions			
					H_2		End-box	
		H_2	End-box		g/d	lb/d	g/d	lb/d
S	225	CO, D, CH, CP	S, CB	1974	548	1.2	5	0.01
				1976	891	2.0	7	0.02
				1979	NA	NA	22	0.05
				1980	610	1.3	32	0.07
				1981	864	1.9	7	0.02
				1982	NA	NA	120	0.26
				1983	528	1.2	NA	NA
T	520	CO, CH, D, CP, SP, MS	B, B, CO	1976	5	0.01	52	0.11
				1978	4	0.01	63	0.14
U	220	CO, CP, S, ME	CO, B, S	1973	61	0.13	2	0.004

[a]Plant names are coded because certain companies requested confidential treatment of data.
[b]Test data using EPA Method 102 for H_2 stream and EPA Method 101 for end-box ventilation stream. "NA" indicates that no test data were available.
[c]Code for control devices:
B = Blower
BS = Brine scrubber
CB = Carbon bed
CC = Centrifugal collector
CH = Chillers
CO = Coolers
CP = Compressors
[illegible] = [illegible]ister
[illegible] = [illegible] collector
D = Driers
F = Filter
HE = Heat exchanger
KO = Knockout drum
ME = Mist eliminator
MS = Molecular Sieve
R = Refrigeration
S = Scrubber
SP = Separator

1. Item 12 should be modified to allow the reuse of hydrogen seal pot water, compressor seal water, and hydrogen cooler condensate instead of requiring it to be treated. Additionally, this water should not be restricted from open trenches. The quantity of mercury in this water is insignificant and exposure of this water to the atmosphere poses no hazard for emitting mercury into the air.

2. Some decomposer pump sumps do not retain an aqueous layer on top of the mercury since the decomposer vent gases are collected and controlled by the end-box ventilation system. Other systems maintain an aqueous layer over the mercury and some systems may have both methods of control. Either method is adequate by itself, therefore, items 8 and 9 should be modified to allow either method to be used instead of both.

3.6.2 Enforcement Aspects

Mercury-cell chlor-alkali plants are located in 16 States. Thirteen of these States have been granted authority to enforce the national emission standards for hazardous air pollutants. Enforcement personnel representing 11 States and 6 EPA regions were contacted to obtain information on enforcement aspects of the mercury standard. No significant enforcement problems have been encountered. However, enforcement personnel did comment on several aspects of the standard. These comments are summarized below.

As discussed in Chapter 2, there are no monitoring or reporting requirements in the standard for chlor-alkali companies. The EPA Region II office requires that chlor-alkali companies submit a semiannual summary of inspection and maintenance records. State personnel in this region noted that the reporting requirement aids in the enforcement of the standard. It provides them with baseline data to evaluate plant performanc and allows them to spot problems as they develop.[31] An EPA Region III representative believes the reporting requirement is more efficient than conducting full plant inspections.[33] One company contacted in this region noted that the requirement does not affect controls and procedures used to comply with the standard but does create additional paperwork.[31]

Enforcement personnel in five States and two regions believed that some type of specific monitoring and reporting requirements should be included in the standard to ensure compliance.[31,33-38] One State

representative suggested that monitoring and reporting requirements be instituted only for those facilities encountering compliance problems.[39] A State agency contacted did not feel monitoring and reporting requirements were necessary but did believe that sources should be tested every 3 to 5 years to demonstrate compliance.[40] Other States and EPA regional personnel contacted in this study did not comment on the need for monitoring and reporting requirements.

Two enforcement personnel noted that the cell room housekeeping practices portion of the standard is a subjective evaluation method because it is not quantifiable.[36,37,41] Additionally, one of these individuals recommended that the EPA should test the cell room vent air and develop a specific numerical emission limit.[36]

3.7 SUMMARY AND CONCLUSIONS

Twenty-four mercury-cell chlor-alkali plants are operating in the United States. All plants are in compliance with the national emission standard for mercury. The EPA cell room housekeeping practices are achievable.

No enforcement problems with the standard have been noted; however, a number of State and EPA regional personnel believe that reporting requirements should be added to the standard.

3.8 REFERENCES FOR CHAPTER 3

1. Chlorine Institute. North American Chlor-Alkali Industry Plants and Production Data Book. Pamphlet 10. New York, N.Y. January 1982. pp. 1 and 2, 16. Docket No. A-82-41, Document No. (II-I-28).

2. Reference 1, p. 12. (II-I-28).

3. Reference 1, p. 15. (II-I-28).

4. Telecon. Sauer, M., MRI, with Laubusch, E., Chlorine Institute. January 18, 1983. Future chlor-alkali production. (II-E-53).

5. Reference 1, pp. 1 and 2. (II-I-28).

6. Reference 7, pp. 3-20 to 3-22. (II-A-2).

7. Kirk-Othmer Encyclopedia of Chemical Technology. Third Edition. Volume I. New York, John Wiley & Sons, Inc. 1978. p. 811. (II-I-13).

APPENDIX A. LIST OF EPA DESIGN, MAINTENANCE, AND HOUSEKEEPING PRACTICES FOR CELL ROOMS OF MERCURY-CELL CHLOR-ALKALI PLANTS

1. Chlorine cells and end-box covers should be installed, operated, and maintained in a manner to minimize leakage of mercury and mercury-contaminated materials.

2. Daily inspection should be made by operating personnel to detect leaks, and immediate steps to stop the leaks should be taken.

3. High housekeeping standards should be enforced, and any spills of mercury should be promptly cleaned up, either mechanically or chemically or by other appropriate means. Each cell room facility should have available and should employ a well-defined procedure for handling these situations.

4. Floor seams should be smoothed over to minimize depressions and to facilitate washing down of the floors.

5. All floors should be maintained in good condition, free of cracking and spalling, and should be regularly inspected, cleaned, and, to the extent practical, chemically decontaminated.

6. Gaskets on denuders and hydrogen piping should be maintained in good condition. Daily inspection should be made to detect hydrogen leaks and prompt corrective action taken. Covers on decomposers, end boxes, and mercury pump tanks should be well maintained and kept closed at all times except when operation requires opening.

7. Precautions should be taken to avoid all mercury spills when changing graphite grids or balls in horizontal decomposers or graphite packing in vertical decomposers. Mercury-contaminated graphite should be stored in closed containers or under water or chemically treated solutions until it is processed for reuse or disposed.

8. Where submerged pumps are used for recycling mercury from the decomposer to the inlet of the chlorine cell, the mercury should be covered with an aqueous layer maintained at a temperature below its boiling point.

9. Each submerged pump should have a vapor outlet with a connection to the end-box ventilation system. The connection should be under a slight negative pressure so that all vapors flow into the end-box ventilati system.

10. Unless vapor tight covers are provided, end boxes of both inlet and outlet ends of chlorine cells should be maintained under an aqueous layer maintained at a temperature below its boiling point.

11. End boxes of cells should either be maintained under a negative pressure by a ventilation system or should be equipped with fixed covers which are leak tight. The ventilation system or end-box covers should be maintained in good condition.

12. Any drips from hydrogen seal pots and compressor seals should be collected and confined for processing to remove mercury, and these drips should not be allowed to run on the floor or in open trenches.

13. Solids and liquids collected from back-flushing the filter used for alkali metal hydroxide should be collected in an enclosed system.

14. Impure amalgam removed from cells and mercury recovered from process systems should be stored in an enclosed system.

15. Brine should not be purged to the cell room floor. Headers or trenches should be provided when it is necessary to purge brine from the process. Purged brine should be returned to the system or sent to a treating system to remove its mercury content.

16. A portable tank should be used to collect any mercury spills during maintenance procedures.

17. Good maintenance practice should be followed when cleaning chlorine cells. All cells when cleaned should have any mercury surface covered continuously with an aqueous medium. When the cells are disassemble for overhaul maintenance, the bed plate should be either decontaminated chemically or thoroughly flushed with water.

18. Brine, alkali metal hydroxide, and water-wash process lines and pumps should be maintained in good condition, and leaks should be minimized. Leaks should be corrected promptly, and in the interim, the leaks should be collected in suitable containers rather than allowed to spill on floor areas.

Reference: U.S. Environmental Protection Agency. Background Information on Development of National Emission Standards for Hazardous Air Pollutants: Asbestos, Beryllium, and Mercury. PB-222802. Research Triangle Park, North Carolina. March 1973. pp. 80-83. Docket No. A-82-41, Document No. (II-A-3).

Site:
Break: 17.7
Other:

Mercury Fact Sheet

Elemental or metallic mercury is the shiny liquid seen in thermometers. It is a naturally occuring element that can exist as a solid or a vapor. Elemental mercury is the major source for human exposure. It occurs throughout the environment because it is naturally released from rocks, soil, and water at room temperature.

Mercury is sometimes used in the production of chemicals, dental fillings, paints, and in photographic developing. Mining, smelting, and industrial discharges can release mercury, as can the burning of gas, coal, and oil.

It can be brought into homes on the clothing of exposed workers. In the home, mercury droplets give off mercury vapor at room temperature. This vapor is breathed in by anyone spending time in the house. Mercury metal can find its way into carpets, draperies, clothing, washing machines, and dryers. It can get into cracks in the floor or into furniture. If a vacuum cleaner is used the heat from the motor can release mercury vapor into the room.

Elemental mercury is not absorbed when swallowed, but is rapidly absorbed when it is inhaled in the form of a vapor. From the lungs it rapidly enters the bloodstream where it is carried to the body. The red blood cells, brain, and kidney concentrate and store mercury.

Once mercury is in the body it is slowly eliminated from the body in the urine and stools so that half is gone in 35 - 90 days. Mercury in the brain is more slowly eliminated. A treatment called chelation binds mercury and speeds its elimination from the body.

Mercury forms a vapor which can cause throat, airway and lung irritation with coughing, bronchitis, and lung injury. Prolonged or repeated exposure affects the nervous system causing lack of energy; tremor or a fine shaking of the hands, jaw, lips, tongue, or eyelids; irritability; gum disease; and excessive salivation (drooling). Excitability, depression, and even hallucinations may occur. Kidney damage is usually not apparent but can occur. A person probably would not notice any symptoms even if the kidneys were affected.

17 7 0020

Site:
Break: 17.7
Other: 1985

Facility Information

Olin Corporation - TND003337292
Lower River Road
Charleston, Tennessee 37310

Facility Description

Olin Corporation, Charleston, Tennesse Facility, is located in Bradley County on Lower River Road, 1.5 miles west of Charleston, Tennessee. The facility property line encloses 1029 acres, with 25 acres for the plant proper. The plant, called Olin Chemicals Division, manufactures the following inorganic chemicals: (1) liquid chlorine, 700 tons(t)/day, (2) 50%(w/w) caustic soda (NaOH), 784 t/day, (3) anhydrous NaOH, 66 t/day, (4) HTH[R] (Calcium hypochlorite, $Ca(OCl)_2$), 225 t/day, and (5) Reductone[R] (Aqueous Sodium hydrosulfite, 130 g $Na_2S_2O_4$ per liter), 65,000 gal/day. Olin Corporation is one of the leading manufacturers of chlorine in the United States, producing over 200,000 metric tons per year by means of the mercury-cell electrochemical process. The raw materials for the finished products above are mercury, rock salt, sulfur dioxide, sulfuric acid, hydrochloric acid, lime, water, and electricity.

The hazardous wastes generated from the manufacture of the five products above, and the amounts produced in 1984, were:

Brine muds, K071, 110 t
Waste water treatment sludge from mercury-cell process, K106, 175 t
Mercury spill residue, U151, 50 t
Mercury-bearing wastes, D009, 89 t
ignitable solvents, D001, 5.5 t
o-dichlorobenzene, U070, 75 pounds (lb)
Halogenated solvents, F001,F002, and paint, D001, 17.3 t
Corrosives, D002, 220 lb

In addition, the following is a list of laboratory wastes generated in 1984. These are chemicals of known composition, the nature and amount of which vary from year to year, and the above totals for corrosives, and ignitable and halogenated solvents include the amounts of these chemicals. The amounts of these chemicals are very small compared to the totals above.

D001 Ignitables: Allyl Alcohol, Butylamine, Chloroform/Toluene, Ethanol, Ethylamine, Ethylbenzene, Hexane, Methanol/Pyridine, Petroleum Ether, 1-Propanol, 2-Propanol, Triethylamine.
"U" Ignitables: Acetone: U002; Benzene: U019; 1-Butanol: U031; Formaldehyde: U122; Furfural: U125; 2-Methyl-Propan-1-ol: U140; Methanol: U154; Methyl Ethyl Ketone: U159; Nitrobenzene: U169.

D002 Corrosives: Chlorosulfonic Acid, Nickel Chloride, Nitric Acid, Octanoic Acid, Oleum, Phosphorus Oxychloride, Sulfuric Acid, Sulfuryl Chloride, Thionyl Chloride.
"U" Corrosives: Formic Acid: U123.

"U" Miscellaneous: Carbon Tetrachloride: U211; Chlorobenzene: U037; o-Dichlorobenzene: U070; 1,2-Dichloroethane: U077; Mercury Flasks (empty): U151; Phenol: U188; 1,2,4,5-Tetrachlorobenzene: U207; 1,1,1-Trichloroethane: U226.

The Olin Corporation has a RCRA permit to operate the surface impoudment and a containers storage area. There are currently two active hazardous waste management units (HWMU) located at the facility. The Retention Pond #1, which was formerly an active RCRA unit west of the plant proper, was closed in July, 1983. It has a cover as specified in the Part B permit application and now has a cover of grass over that. Three active retention ponds are not RCRA-regulated units, but are settling ponds for plant water effluent that is purified before discharge to NPDES Outfall 001.

The largest unit is clasified as a surface impoundment (SI), D83, but could also be classified as a landfill. The SI has a capacity of 4,000,000 gal of waste, and is used for disposal of wastes, D009, K071, K106, and U151. The SI is east of the plant proper, has an elevation of about 740 feet MSL, and is covered with a positive-pressurized dome of Tedlar-coated nylon.

The other unit is a drum storage area (DS), S01, west of the dry caustic plant, that is used for storage of wastes, D001, D002, F001, F002, and all the "U" wastes listed above, prior to shipment off site for disposal. The storage capacity of DS is a total of 3300 gallons supplied by 55-gallon drums. The elevation of DS is approximately 705 feet MSL. As shown in the Part B application, the elevations of both SI and DS are such that neither is threatened by the 100-year flood plain.

Wastes that are disposed of on-site are transported in red hoppers, which are dedicated to and reserved for hazardous waste only.

Brine mud that has <.09 ppm EP toxicity mercury was delisted by TDHE on July 18, 1983. Olin test all brine mud before storage/disposal; brine mud that has >0.05 ppm EP toxicity mercury is dispoed of in the SI described above. Brine mud that ppm EP toxicity mercury is stored in delisted brine mud sludge pit.

INFORMATION REGARDING POTENTIAL RELEASES FROM SOLID WASTE MANAGEMENT UNITS

FACILITY NAME: OLIN CORPORATION

EPA I. D. NUMBER: TND 003 337 292

LOCATION City: Charleston (Bradley County)

State: Tennessee

1. Are there any of the following solid waste management units (existing or closed) at your facility? NOTE - DO NOT INCLUDE HAZARDOUS WASTES UNITS CURRENTLY SHOWN IN YOUR PART B APPLICATION

	YES	NO
• Landfill	X	
• Surface Impoundment	X	
• Land Farm		X
• Waste Pile		X
• Incinerator		X
• Storage Tank (Above Ground)		X
• Storage Tank (Underground)		X
• Container Storage Area		X
• Injection Wells		X
• Wastewater Treatment Units	X	
• Transfer Stations		X
• Waste Recycling Operations	X	

2. If there are "Yes" answers to any of the items in Number 1 above, please provide a description of the wastes that were stored, treated or disposed of in each unit. In particular please focus on whether or not the wastes would be considered as hazardous wastes or hazardous constituents under RCRA. Also include any available data on quantities or volumes of wastes disposed of and the dates of disposal. Please also provide a description of each unit and include capacity, dimensions, location at facility, provide a site plan if available.

See Attachment 1

NOTE: Hazardous waste are those identified in 40 CFR 261. Hazardous constituents are those listed in Appendix VIII of 40 CFR Part 261.

3. For the units noted in Number 1 above and also those hazardous waste units i your Part B application, please describe for each unit any data available on any prior or current releases of hazardous wastes or constituents to the environment that may have occurred in the past or still be occurring.

   Please provide the following information

   a. Date of release
   b. Type of waste released
   c. Quantity or volume of waste released
   d. Describe nature of release (i.e., spill, overflow, ruptured pipe or tank etc)

   Inactive Sites - See Attachment 2, Olin's June 4, 1984 "Response to Commissioner's Order No. 84-132" and Attachment 3, "Geohydrological Assessment of the West Disposal Area". Closed RCRA Pond 1 - See Attachment 4, "Pond Area Geohydrological Study". No known releases of hazardous wastes from Part B RCRA units.

4. In regard to the prior releases described in Number 3 above, please provide (for each unit) any analytical data that may be available which would descrit the nature and extent of environmental contamination that exists as a result such releases. Please focus on concentrations of hazardous wastes or constituents present in contaminated soil or groundwater.

   See Attachments 2, 3, and 4 noted above

Signature and Certification

As with reports in RCRA Permit Applications, submittal of this information must contain the following certification and signature by a principal executive office of at least the level of Vice President or by a duly authorized representative of that person:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signature

K. G. Cooper, Plant Manager
Name and Title (Typed)

JTT 2/20/85

ATTACHMENT 1

2. Landfills

A. Four (4) inactive (closed) sites, approximately 43,000 yds³, K106, K071, D009, HTH® waste, and general plant debris; 1962-1980. (See Attachment 2)

B. HTH® Landfill - Nonhazardous waste landfill, approximately 2,000 yd³ of nonhazardous HTH® to date, approximately 400 yd³/yr disposal; 1980-1983

C. Brine Sludge Landfill - Nonhazardous waste disposal landfill for brine sludge with EP mercury content less than 50 ppb; 5,651 tons; 1983-1985

Surface Impoundments

RCRA Pond 1 closed; 500' x 500' x 6'; 23,000 yd³, K106, K071, D009, and other inert solids; 1962-1982. (See also Wastewater Treatment Units below)

Wastewater Treatment Units

A. Sulfide precipitation/filtration for mercury removal; 150,000 gal/day (RCRA exemption for NPDES regulated tanks); 1971-1985

B. Activated carbon adsorption units for mercury removal, D009; approximately 14 tons/yr (RCRA exemption for NPDES regulated tanks)

C. Overchlorination - decomposition of hypochlorite, 250 gal/min (design capacity) (RCRA exemption for NPDES regulated tanks)

D. Three NPDES nonhazardous wastewater retention ponds

Waste Recycle Operation

Retort for mercury recovery; 50 tons/yr as needed; D009 ash is disposed in RCRA hazardous waste landfill.

WCR/vrp
48/WCR1
2/18/85

III. PLANT OPERATIONS

A. Finished Products - Rated Capacity

Liquid Chlorine - 700 tons/day
Caustic Soda - 784 tons/day
HTH® - 225 tons/day
Sodium Hydrosulfite - 65,000 gal/day
Dry Caustic - 66 tons/day

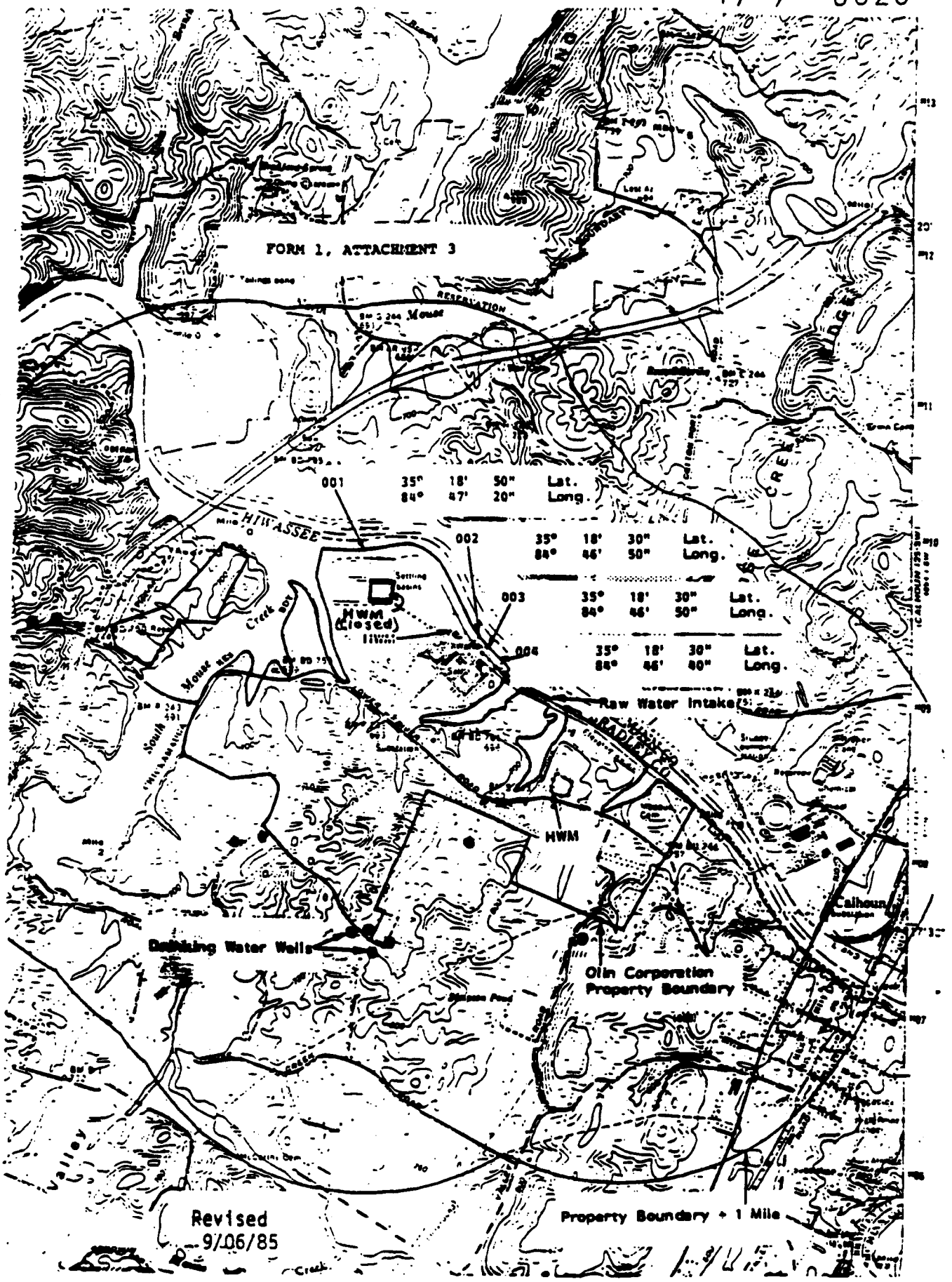
B. Principal Raw Materials

Mercury
Sodium Chloride (Rock Salt)
Sulfuric Acid
Water
Electricity
Muriatic Acid
Calcium Hydroxide
Sulfur Dioxide

IV. HAZARDOUS WASTE MANAGEMENT UNITS

There are currently two active hazardous waste management units located at the Charleston facility. Retention Pond No. 1 is a closed RCRA facility. These, together with the types of waste stored or disposed, are as follows:

Management Unit	Location	EPA Waste Code	Waste Description
Hazardous Waste Disposal Unit (disposal in a surface impoundment)	East of Plant Proper	D009	Mercury-bearing wastes
		K071	Brine muds
		K106	Wastewater treatment sludge
		U151	Mercury spill residue
Retention Pond No. 1 (Closed)	West of Plant Proper	D009	Mercury-bearing wastes
		K071	Brine muds
		K106	Wastewater treatment sludge
		U151	Mercury spill residue


FORM 1, ATTACHMENT 3
001 35° 18' 50" Lat. 84° 47' 20" Long.
002 35° 18' 30" Lat. 84° 46' 50" Long.
003 35° 18' 30" Lat. 84° 46' 50" Long.
004 35° 18' 30" Lat. 84° 46' 40" Long.
HWM (Closed)
Raw Water Intake
HWM
Drinking Water Wells
Olin Corporation Property Boundary
Property Boundary + 1 Mile
Revised 9/06/85

RESPONSE TO COMMISSIONER'S ORDER NO. 84-132

Dated March 14, 1984

The following comments are in response to specific information requested under Paragraph IX. B.2. of the subject Order:

IX. B.2.a. Types and quantities of hazardous substances disposed at the site.

Information on the types and quantities of hazardous waste disposed at the site was presented in "Report on Potential Hazardous Waste Disposal Facility" (Attachment 1) hereto submitted to Tom Tiesler, Director, Division of Solid Waste Management, on June 28, 1982. This information contained a description of each waste, the source of the waste, the storage/disposal method, an estimated quantity disposed per month, and the concentrations of the hazardous characteristics of the waste. No new information is available on the types and quantities of hazardous substances. In addition to brine muds, wastewater treatment sludge, and other miscellaneous mercury contaminated wastes, HTH plant waste (non-hazardous calcium hypochlorite) was also disposed in the South, East, and West Disposal Areas. Brine muds, as currently generated, have been demonstrated to be non-hazardous after draining and have been delisted by TN DSWM and by the USEPA. The delisting was based on analytical results from the EP extract from brine muds showing the mercury content to be less than 50 ppb.

South Disposal Area - 1962 Through 1971

The plant's South Disposal Area was used for waste disposal from early 1962 through the first quarter of 1971. Brine muds, miscellaneous chlor-alkali wastes, and HTH plant wastes were disposed of at this location.

Based on employee interviews, HTH[R] plant wastes were generally deposited within a small ravine at the south end of the site and the chlor-alkali wastes were deposited along the northwestern slope of the site. Some intermixing may have occurred. Native soil from a hill east of the site was periodically used for cover resulting in the filling of the southern portion of the site and a gradual extension of the northwestern portion of the site.

The site was closed during the Spring of 1971 by grading the waste down the slope, excavating additional natural soils from the eastern elevation, covering, contouring the entire site, and then seeding.

There is no known record of the depth of cover, however, minor erosion that had occurred by 1979 indicated generally two feet of cover over most of the site. Repairs to areas of erosion, placement of additional topsoil, and reseeding were done in 1979. Recent inspection of this site revealed several minor areas of vegetation stress apparently due to high chloride concentration. In addition, some exposure of remnants of what is believed to be hardened brine sludge along the western toe of the covered area was caused by recent heavy rains.

Since erosion of the type described above continues to require periodic maintenance, the plant is presently improving the natural drainage of the western toe of the site.

East Disposal Area - 1971 Through 1973

The plant's East Disposal Area was a trench and fill operation starting in the Spring of 1971 and ending during the year of 1973. Wastes from both chlor-alkali and HTH[R] plant were placed into two trenches. The trenches were constructed approximately 500 feet in length, 14 feet wide, and 6-8 feet in depth. Wastes were placed from the ends and sides of the trenches. Water was periodically pumped from the trench to the plant's secondary treatment system. This disposal was discontinued in late 1973. Cover for the trench was obtained by removing earth from an area just south and adjacent to the trench site. Some of the residual material from the sides of the trenches was buried in this adjacent excavation. The total area was closed by contouring, covering, and seeding. The site laid dormant until 1979 when additional covering and seeding were done. The presence of minor miscellaneous debris and the lack of vegetation in some areas of disposal have been noted.

Miscellaneous Disposal Area - 1968

Around 1968, it became necessary to dredge the plant's No. 1 Retention Pond. This operation was accomplished by a contract with an outside dredging firm. Initially, the contractor constructed a small cofferdam on the south side of the present road leading to the retention pond. The area within the cofferdam has been designated as the Miscellaneous Disposal Area. The cofferdam location was just west of the present railroad spur leading to HTH[R] shipping. The dredge spoil settling area was soon abandoned due to pumping problems and an additional cofferdam was put in place on the north side of the road leading to No. 1 waste pond. This settling area was located some 100 to

150 feet east of the pond itself. It is believed that it is in this location, which is part of the West Disposal Area, that the bulk of the dredge spoils was pumped and settled.

It was originally assumed that the dredge spoils deposited at the original cofferdam location, i.e., southeastern location, had been left in place and that these materials were utilized as fill for a warehousing complex constructed between November 1969 and December 1970. More recent discussions with the construction supervisor in charge of that particular project indicates that the material was not suitable for compacted fill and was removed from the area and placed as general fill in the West Disposal Area. There should be little, if any, mercury contaminated materials left in what has been designated as the Miscellaneous Disposal Area. In late 1969 and 1970, topsoils were removed from this area and 4 to 6 feet of compacted clean fill was put in place for the construction of a number of modular HTH storage warehouses which remain on site today.

West Disposal Area - 1968 Through 1979

As noted in the discussion of the Miscellaneous Disposal Area, the West Disposal Area began in about 1969 as a spoils area for wastes from the plant's No. 1 Retention Pond. There is also evidence from discussions with various plant personnel that material originally placed in a spoils area on the south side of the road (Miscellaneous Disposal Area) leading to the pond had been removed and placed as general fill in the West Disposal Area. There is also evidence that occasional dumping of brine sludge in this area to provide fill for a general salvage yard laydown area may have begun as early as 1968.

Plant disposal activities were initiated at this location with the closure of what was known as the East Disposal Area (1973). Solid wastes disposed at the location consisted of brine muds, miscellaneous chlor-alkali wastes, HTH[R] wastes, and general plant debris (wood, fill dirt, demolition articles or materials, buckets, drums, etc.). The filling of the area generally progressed in a westerly direction with the filled area being utilized as a salvage yard laydown area for the plant. In addition, because of the previously constructed cofferdam at the western end of the site, plant waste effluents were from time to time diverted and pooled within the area. The effluents could either be discharged to or from the area by a pipe to the plant's process sewer system.

During 1979, action was taken to initiate the closeout of this disposal area. Prior to these closure activities, a series of monitoring wells were installed on and surrounding both the West Disposal Area and the plant retention ponds. The closure of the West Disposal Area included the placement of at least two feet of compacted clay (1×10^{-4} to 1×10^{-5} cm/sec permeability), a minimum of one foot of native soil on top of the compacted clay, and a minimum of six inches of topsoil for seeding. The cover was contoured to provide proper water management and a groundwater monitoring program via existing and additional well installation was initiated. The area was enclosed with a four-foot high chain-link fence and posted.

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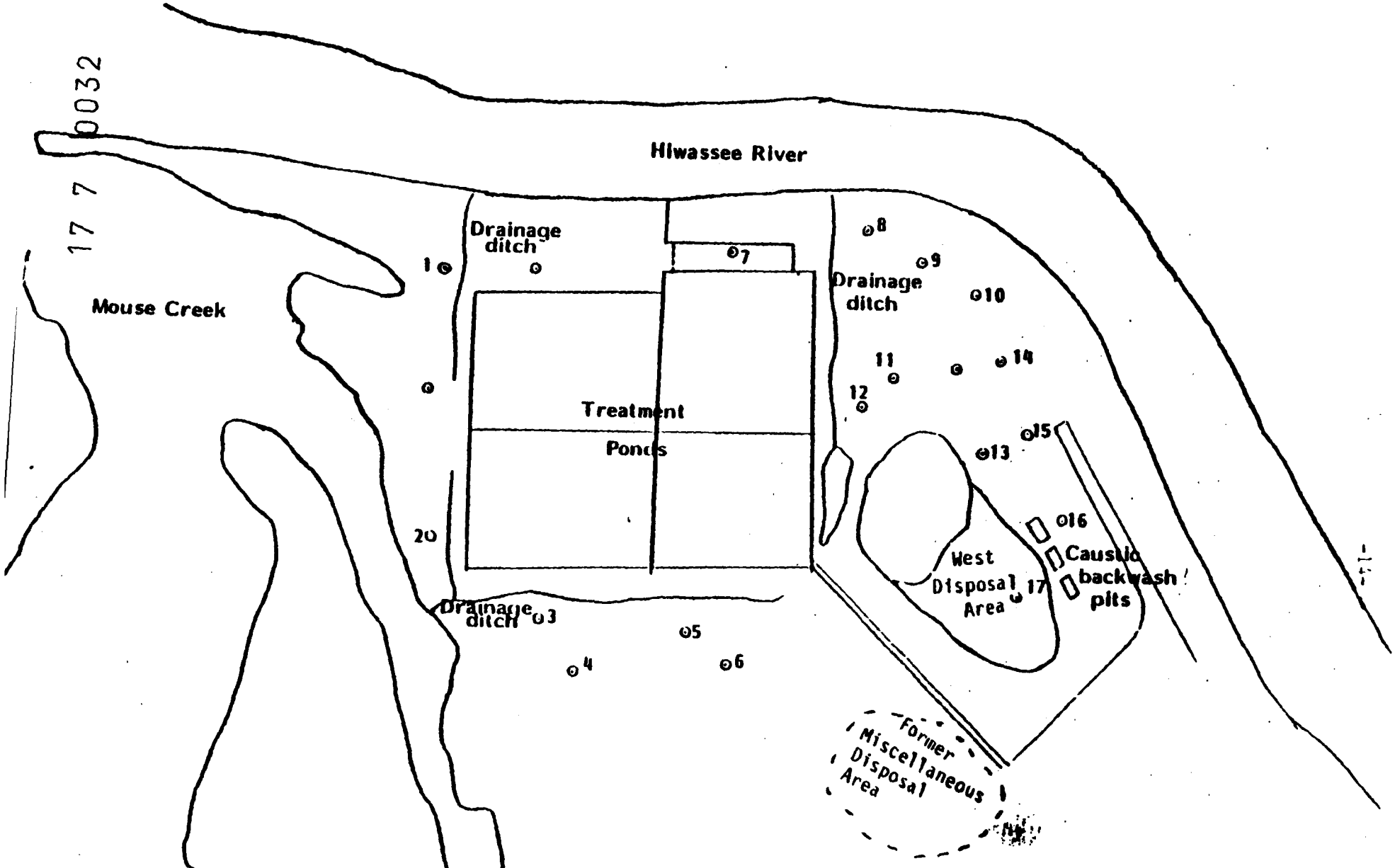


FIGURE 1: Landfill/pond area with monitoring well designation.

17 7 0033

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT
SOUTHEAST REGIONAL OFFICE
2501 MILNE STREET
CHATTANOOGA, TENNESSEE 37406-3390

July 12, 1988

Mr. M. S. Davenport, Plant Manager
Post Office Box 248
Charleston, Tennessee 37310

RE: INSPECTION UNDER THE
TENNESSEE HAZARDOUS WASTE
MANAGEMENT ACT
OLIN CHEMICAL CORPORATION
TND 00-33-7292

Dear Mr. Davenport:

This letter confirms the observations and/or recommendations which were made during the hazardous waste Permit inspection concerning your facility on June 17, 1988.

No violations of the regulations promulgated under the authority of the Tennessee Hazardous Waste Management Act were noted; however, a copy of the inspection report is attached for your information and review.

If you desire any assistance or need clarification regarding this correspondence, please feel free to contact me at (615) 624-9921.

Sincerely,

James C. Childress

James C. Childress
Chemist
Division of Solid Waste Management

JCC:pph

Enclosure

cc: Division of Solid Waste Management, Nashville
Doyle Brittian, USEPA, Region IV, Atlanta, GA
Bradley County Health Department

INSPECTION REPORT

1. Site/Operation Inspected:

   Olin Chemical Corporation - Charleston Plant
   TND 00-333-7292
   Lower River Road
   Charleston, Tennessee 37310
   Bradley County

2. Primary Contact:

   Mr. J. P. Newman, Manager
   Product Quality and Environmental Control
   Olin Chemical Corporation
   Post Office Box 248
   Charleston, Tennessee 37310
   (615) 336-4000

3. Date and Time of Inspection:

   June 17, 1988
   9:30 a.m. - 2:00 p.m.

4. Report Prepared By:

   James C. Childress, Chemist
   Tennessee Department of Health and Environment
   Division of Solid Waste Management
   2501 Milne Street
   Chattanooga, Tennessee 37406
   (615) 624-9921

5. Names and Affiliations of Other Inspection Participants:

   Richard Rowe, Olin Chemical Corporation
   Dan Bennewitz, Olin Chemical Corporation
   Jack O'Grady, Olin Chemical Corporation
   Guy Moose, DSWM

6. Purpose of Inspection:

   To evaluate Olin Chemical Corporation's compliance with the Permit requirements of September 28, 1987. (Groundwater Monitoring requirements were not addressed during this inspection).

   An inspection was also condusted to evaluated the facility's compliance with the EPA land ban restrictions of November 8, 1986 and July 8, 1987. No violations of these requirements were observed.

7. Facility Description:

   Nature of Business:

   (a) Manufacturer of chlorine and sodium hydroxide using the mercury electrolytic cell process.

(b) Manufacturer of sodium hydrosulfite (reductone) using the mercury electorlytic cell process and chemical reaction process.

Types and Amounts of Hazardous Waste Generated:

(a) Brine purification muds from the mercury cell process (K071); 500,000 kg/yr

(b) Wastewaters (D009); 200,000,000 kg/yr

(c) Retort Ash (D009); 33,000 kg/yr

(d) Sodium Chromate (D007) 500 kg/yr

(e) Wastewater treatment sludge from mercury cell process in chlorine production (K106) 300,000 kg/yr

(f) Reductone filters (D009); 5000 kg/yr

(g) Waste Nickel Plating Solution; sporadic

(h) Ortho-dichlorobenzene/Petroleum Ether (F002), (D001); 800 kg/yr

(i) Rubber Cement (D001); sporadic

(j) Methanol/Pyridine (D001); 0-400 kg/yr

(k) Hexane/Acetone (D001); 1000 kg/yr

(l) Waste Paint (D001); 7000 kg/yr

(m) Mercury Contaminated Wastes (D009); 1,800,000 kg/yr

(n) Laboratory Wastes (D001), (D002), (U122), *U037), (U220), (U125), (U031), U077), (U003), (U226), (U154), (U019), (U159), (u140), (U169), (U123), (U211), (U188), (U207), (U002), (U070); 300 kg/yr

(o) Mercury contaminated flasks (D009) 1,000 kg/yr

Facility Status:

Treatment, Storage, and Disposal Facility (TSDF)

(a) (D001), (F001), (F002), and lab pack wastes are stored in fifty-five gallon drums at the facility's on-site storage area prior to shipment off-site for disposal.

(b) (K071), (U151), (K106), and (D009) wastes are disposed of at the facility's hazardous waste disposal impoundment for mercury contaminated wastes.

(c) Mercury contaminated wastewaters were being treated on-site and discharged under an N.P.D.E.S. Permit. The on-site treatment facility met the definition of a wastewater treatment unit as defined in Rule 1200-1-11-.01(2)(a) and was subject to the permit-by-rule requirements of Rule 1200-1-11-.07(1)(c)1(iii).

8. Inspection Findings:

No violations were observed.

9. Comments/Recommendations:

This facility must get a variance, from the State, in order to operate an on-site solvent distillation unit.

Signed James C. Childers

Dated 7-13-88

17 7 0037

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT
SOUTHWEST TENNESSEE REGIONAL OFFICE
295 SUMMAR AVENUE
JACKSON, TENNESSEE 38301-3984

March 23, 1988

Mr. M.S. Davenport
Plant Manager
Olin Corporation, Charleston Facility
P. O. Box 248
Charleston, TN 37310

Re: Comprehensive Groundwater Monitoring Evaluation
Hazardous Waste Disposal Unit

Dear Mr. Davenport:

This letter is in reference to the Groundwater Monitoring Evaluation of the Hazardous Waste Disposal Unit I conducted on December 1, 1987. No violations were found during the inspection.

I appreciate the courtesy extended to me during my visit to your facility and if I can be of assistance in the future, you may contact me at (901)424-5200, extension 329.

Respectfully,

Original Signed

Michael David
Geologist
Division of Solid Waste Management

MHD/rc

Enclosure

cc: DSWM, Nashville, Dwight Hirch
DSWM, Chattanooga, Steve Baxter
DSWM, Jackson, File

MAR 25 1988

COMPREHENSIVE GROUNDWATER MONITORING EVALUATION
HAZARDOUS WASTE DISPOSAL UNIT (HWDU)
OLIN CORPORATION, CHARLESTON PLANT
TNC 00333 7292

INTRODUCTION

A comprehensvie groundwater monitoring evaluation (CME) was conducted for the Olin Corporation, Charleston Plant Hazardous Waste Disposal Unit (HWDU). The evaluation consisted of an offsite geological and record review (conducted Nov. 23 & 24, 1987), an onsite field/record inspection (conducted December 1, 1987), and a sampling inspection (conducted Dec. 8, 1987). The following personnel were present during the inspection.

Name	Organization	Area
Dan Bennewitz	Olin Corp.	Field/Record Insp.
Haskall Swafford	Olin Corp.	Field Sampling
Jim Childress	DSWM	Field Sampling
Michael David	DSWM	Geological, Field/ Record Inspection

BACKGROUND

Facility Location

The Olin, Charleston HWDU is located about 1 1/2 miles northwest of Charleston, Tennessee. The site is located approximately 1/2 mile southeast of the Olin, Charleston main plant. A general map of the HWDU area is shown in Figure 1.

Geology/Hydrogeology

The area in the vicinity of the HWDU is located in the Valley and Ridge Physiographic Province of eastern Tennessee. The surficial materials consist of residual soils formed by the in place weathering of the underlying limestone and shales of the Nolichucky Formation. In general, soil thicknesses range from in excess of 30 feet in the east central portions of the site, to between 10 and 25 feet over most of the remaining site, except where outcrops occur. The bedrock surface is characterized by an irregular occurance of pinnacles and slots.

Geology/Hydrogeology - con't

The Olin site area is underlain by the Nolichucky member of the Conasauga Group formations of Upper Cambrian age. The Conasauga Group is subdivided (Swingle, 1988) into three mappable units; (1) a lower siltstone and shale sequence, (2) overlying clay shales and limestone of the Nolichucky Formation, and (3) the Maynardville limestone. The site area is underlain by both the middle limestone and shale sequence of the Nolichucky Formation. Two sets of joints occur in the Nolichucky Limestone, one along bedding and the other perpendicular to bedding.

Groundwater at the site occurs under water table conditions in soil and fractured rock. A north-south trending groundwater divide underlies the site. Groundwater flows in opposite directions on either side of this divide.

EVALUATION OF RCRA GROUND WATER MONITORING PROGRAM

Applicability Rule 1200-1-11-.05(6)(a)1

The RCRA groundwater monitoring program at Olin's Hazardous Waste Disposal Unit was implemented in 1981 and has been carried out to date. Although other inactive disposal sites, including the RCRA regulated Pond 1 area, are located at the Olin facility, the HWDU has a separate groundwater monitoring system and it is this system alone that this report addresses.

Ground Water Monitoring System Rule 1200-1-11-.05(6)(b)1

The current RCRA monitoring well system (see Figure 1) consists of the following:

Well	Screen Zone	Location
B 24 S	Soil	Downgradient
B 24 B	Rock	Downgradient
B 25 S	Soil	Downgradient
B 25 B	Rock	Downgradient
WW 1 S	Soil	Downgradient
WW 1 B	Rock	Downgradient
WW 2 S	Soil	Upgradient
WW 2 B	Rock	Upgradient
B 5 R	Rock	Downgradient
B 5 A	Soil	Downgradient
B 10 R	Rock	Downgradient
B 10	Soil	Downgradient
B 7W R	Rock	Upgradient
B 7W	Soil	Upgradient
B 97 S	Soil	Downgradient
B 97 R	Rock	Downgradient

Ground Water Monitoring System - con't

These wells are a collection of original piezometers drilled into bedrock and newly drilled wells screened into soil portions of the aquifer. Additional well clusters were drilled to provide better horizontal coverage around the HWDU. The well system should provide adequate vertical and horizontal coverage of the uppermost aquifer around the HWDU as required by Rule 1200-1-11.05(6)(b)1.

Monitoring well construction is adequate and meets the requirements of Rule 1200-1-11-.05(6)(b)3.

Groundwater Flow Directions/Monitoring Well Gradient Relationships. Rule 1200-1-11-.05(6)(c)5

Groundwater levels were measured at six (6) of the RCRA designated wells at the time of sampling and prior to the purging of the wells. Gradients obtained from this measurement and historical water level data have shown groundwater to flow to the east and west in opposite directions of the north-south trending groundwater divide underneath the site. Based upon this data monitoring well location appears to be correct. Groundwater flow directions from beneath the site should be adequately covered by the current groundwater monitoring system.

Sampling and Analysis (Rule 1200-1-11-.05(6)(d)1

The facility maintains a sampling and analysis plan (SAP) which describes procedures and techniques for sample collection, sample preservation, shipment, analytical procedures and chain of custody control. During the sampling inspection Olin personnel correctly followed the techniques for sample collection and water level measurement and as documented in the CME checklist the SAP should be adequate for the RCRA groundwater monitoring program as required by Rule 1200-1-11-.05(6)(d)1.

Since the implementation of the ground water monitoring program Olin has been sampling and analyzing as required by Rule 1200-1-11.05(6)(c)4(i)(ii).

Olin maintains a groundwater quality assessment plan at the facility and it appears adequate to meet the requirements of Rule 1200-1-11-.05(6)(d)1.

Olin has maintained adequate record keeping and submitted all reporting as required by Rule 1200-1-11-.05(6)(e)1.

SAMPLING

On December 8, 1987 samples were taken from six (6) of the designated RCRA monitoring wells. Specific conductance and pH were field measured. The DSWM ran samples for mercury and chlorides. Although complete analytical results are attached, in general the following results are evident: pH ranged from 6.5 to 7.1, specific conductance ranged from 220 to 650 (umhos/cm), chlorides ranged from 9 mg/l to 82 mg/l and mercury was below 0.2 ug/l in all samples except the sample from well #B 25 B which had 0.86 ug/l of mercury.

<u>Well #B10R, Downgradient</u>
Chlorides 9 mg/l
Mercury < 0.2 ug/l
Specific Cond. 220
pH 6.9
20.54' to water
27.25 - total depth

<u>Well # B7WR, Downgradient</u>
Chlorides 9
Mercury < 0.2
Specific Cond. 335
pH 7.1
41.74' to water
61.25 - total depth

<u>Well #WW1B, Downgradient</u>
Chlorides 7
Mercury < 0.2
Specific Cond. 250
pH 6.7
19.40' to water
52.50 - total depth

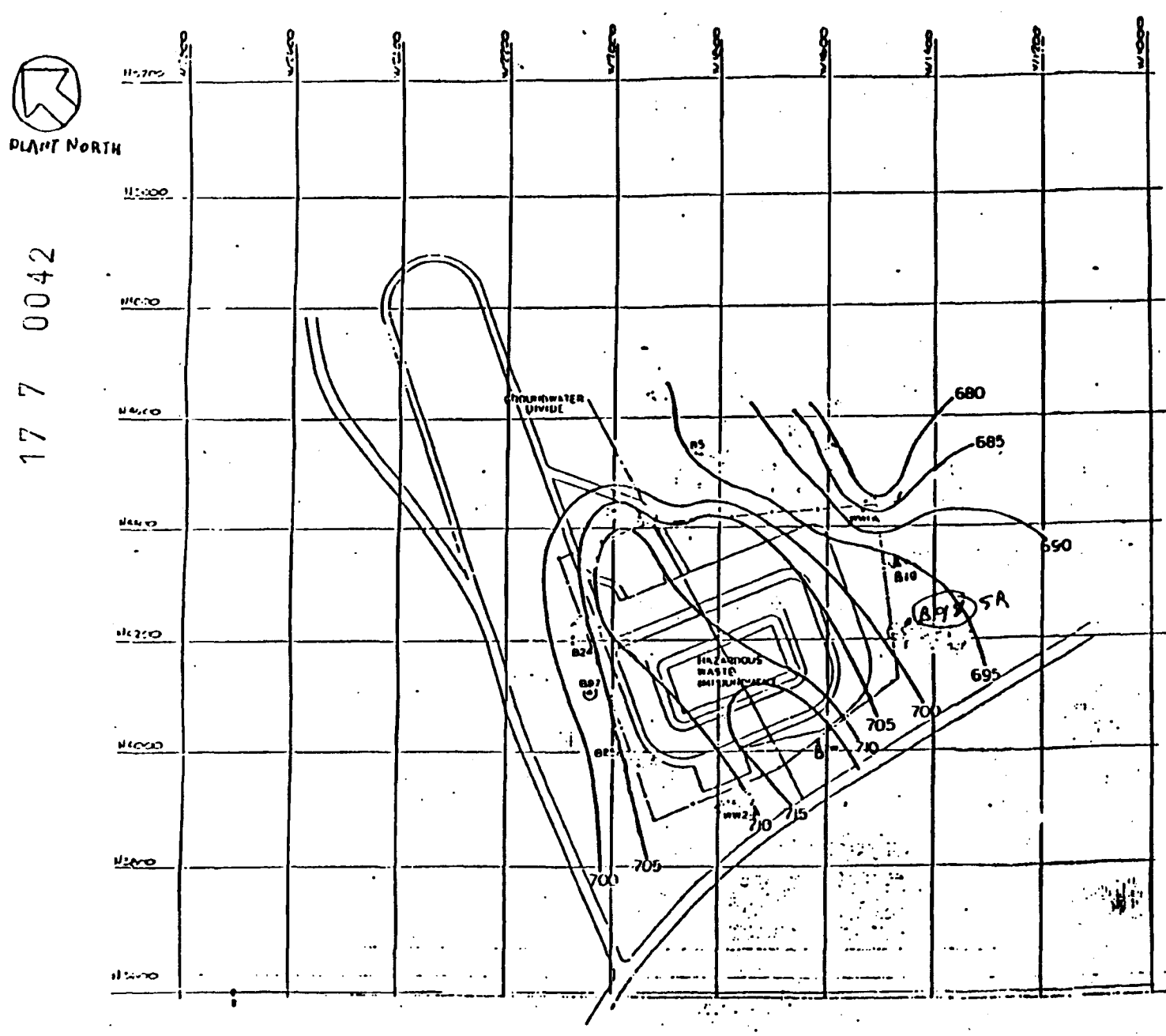
<u>Well #WW2B, Upgradient</u>
Chlorides 82
Mercury < 0.2
Specific Cond. 550
pH 6.7
46.54' to water
74.60 - total depth

<u>Well #B25B, Downgradient</u>
Chlorides 21
Mercury < 0.2
Specific Cond. 360
pH 6.5
47.72' to water
70.88' - total depth

<u>Well #B25B, Downgradient</u>
Chlorides 32
Mercury 0.86
Specific Cond. 650
pH 6.5
44.9' to water
61.25' - total depth

MHD/rc

17 7 0042



Wells WW-2, B-25, B-24 & WW-1 monitor the bedrock portion of the equifer.

Well B-5 monitors the residual soil portion of the aquifer.

Future wells installed at WW-2, B-25, B-24, WW-1 (residual soil monitoring) B-5C Bedrock monitoring B-7W, B-10, B-97 well-clusters at each to monitor soil and bedrock. B-105

add B-98S & B98R

B-99S & B99R

soil aquifers expand [illegible] bedrock.

A APPROX LOCATIONS OF PURPOSED NEW WELLS

FIGURE 12 (Rev [illegible])

VWALLACE 12-1-86	Olin	HAZARDOUS WASTE LANDFILL	
		BEDROCK SURFACE CONTOURS & GROUNDWATER DIVIDE	
	1481	D-1481-430-10	0

UTS - 3 (20

RCRA INSPECTION REPORT 17 7 0043

APR 28 1987

1) Inspector and Author of Report

Judy Sophianopoulos
Environmental Scientist

2) Facility Information

Olin Corporation - TND003337292
Mailing Address:
Post Office Box 428
Charleston, Tennessee 37310
Location:
Lower River Road
Charleston, Tennessee 37310

3) Responsible Official

J. P. Newman, Manager
Product Quality and Environmental Control

4) Inspection Participants

Jim Childress, TDHE
C. Richard Rowe, Olin
Dan Bennewitz, Olin
Jack O'Grady, Olin
J. H. Swafford, Olin*
J. P. Newman, Olin†
Javier Garcia, USEPA
Judy Sophianopoulos, USEPA

5) Date and Time of Inspection

April 7, 1987
9:30 A.M.

6) Applicable Regulations

Tennessee [redacted] 1200-1-11-.05 and 1200-1-11-.03

7) Purpose [redacted]

To conduct [redacted] oversight of a state inspection of the facility for evaluation of compliance (EI); the most recent previous EI inspection by the state was on February 26, 1986. The most recent previous USEPA inspection was a partial, walk-through survey on March 3, 1987.

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* Mr. Swafford was present during the records review.
† Mr. Newman was present briefly following the site inspection and at the end of the exit interview.

8) Facility Description

Olin Corporation, Charleston, Tennesse Facility, is located in Bradley County on Lower River Road, 1.5 miles west of Charleston, Tennessee. The facility property line encloses 1029 acres, with 25 acres for the plant proper. The plant, called Olin Chemicals Division, manufactures the following inorganic chemicals: (1) liquid chlorine, 700 tons(t)/day, (2) 50%(w/w) caustic soda (NaOH), 784 t/day, (3) anhydrous NaOH, 66 t/day, (4) HTH^R (Calcium hypochlorite, $Ca(OCl)_2$), 225 t/day, and (5) Reductone^R (Aqueous Sodium hydrosulfite, 130 g $Na_2S_2O_4$ per liter), 65,000 gal/day. Olin Corporation is one of the leading manufacturers of chlorine in the United States, producing over 200,000 metric tons per year by means of the mercury-cell electrochemical process. The raw materials for the finished products above are mercury, rock salt, sulfur dioxide, sulfuric acid, hydrochloric acid, lime, water, and electricity.

The hazardous wastes generated from the manufacture of the five products above, and the amounts produced in 1984, were:

Brine muds, K071, 110 t
Waste water treatment sludge from mercury-cell process, K106, 175 t
Mercury spill residue, U151, 50 t
Mercury-bearing wastes, D009, 89 t
Ignitable solvents, D001, 5.5 t
o-dichlorobenzene, U070, 75 pounds (lb)
Halogenated solvents, F001,F002, and paint, D001, 17.3 t
Corrosives, D002, 220 lb

In addition, the following is a list of laboratory wastes generated in 1984. These are chemicals of known composition, the nature and amount of which vary from year to year, and the above totals for corrosives, and ignitable and halogenated solvents include the amounts of these chemicals. The amounts of these chemicals are very small compared to the totals above.

D001 Ignitables: Allyl Alcohol, Butylamine, Chloroform/Toluene, Ethanol, Ethylamine, Ethylbenzene, Hexane, Methanol/Pyridine, Petroleum Ether, 1-Propanol, 2-Propanol, Triethylamine.
"U" Ignitables: Acetone: U002; Benzene: U019; 1-Butanol: U031; Formaldehyde: U122; Furfural: U125; 2-Methyl-Propan-1-ol: U140; Methanol: U154; Methyl Ethyl Ketone: U159; Nitrobenzene: U169.

D002 [illegible]es: Chlorosulfonic Acid, Nickel Chloride, Nitric Acid, Octa[illegible]d, Oleum, Phosphorus Oxychloride, Sulfuric Acid, Sulf[illegible]oride, Thionyl Chloride.
"U" Corrosives: Formic Acid: U123.

"U" Miscellaneous: Carbon Tetrachloride: U211; Chlorobenzene: U037; o-Dichlorobenzene: U070; 1,2-Dichloroethane: U077; Mercury Flasks (empty): U151; Phenol: U188; 1,2,4,5-Tetrachlorobenzene: U207; 1,1,1-Trichloroethane: U226.

The Olin Corporation has interim status at the present time, and, according to the Waste Engineering Section, is expected to be a fully permitted facility before the end of 1987. There are currently two active hazardous waste management units (HWMU) located at the facility. The Retention Pond #1, which was formerly an active RCRA unit west of the plant proper, was closed in July, 1983. It has a cover as specified in the Part B permit application and now has a cover of grass over that. Three active retention ponds are not RCRA-regulated units, but are settling ponds for plant water effluent that is purified before discharge to NPDES Outfall 001.

The largest unit is clasified as a surface impoundment (SI), D83, but could also be classified as a landfill. The SI has a capacity of 4,000,000 gal of waste, and is used for disposal of wastes, D009, K071, K106, and U151. The SI is east of the plant proper, has an elevation of about 740 feet MSL, and is covered with a positive-pressurized dome of Tedlar-coated nylon.

The other unit is a drum storage area (DS), S01, west of the dry caustic plant, that is used for storage of wastes, D001, D002, F001, F002, and all the "U" wastes listed above, prior to shipment off site for disposal. The storage capacity of DS is a total of 3300 gallons supplied by 55-gallon drums. The elevation of DS is approximately 705 feet MSL. As shown in the Part B application, the elevations of both SI and DS are such that neither is threatened by the 100-year flood plain.

Wastes that are disposed of on-site are transported in red hoppers, which are dedicated to and reserved for hazardous waste only.

Brine mud that has <.09 ppm EP toxicity mercury was delisted by TDHE on July 18, 1983. Olin tests all brine mud before storage/disposal; brine mud that has >.05 ppm EP toxicity mercury is disposed of in the SI described above. Brine mud that has <.05 ppm EP toxicity mercury is stored in delisted brine mud sludge pit.

9) Findings

All manifests, inspection logs, records of waste and ground water analyses, personnel training records, the contingency plan, closure/post-closure plans, and financial assurance for closure/post-closure, sudden and non-sudden accidental occurences liability (total assets >$1.5 billion) were well organized, complete, and in full compliance with RCRA regulations and Tennessee Rules for hazardous waste management.

Complete [illegible]al manifests of waste disposed of on site are also kept.

No incompatible wastes were stored in DS; asbestos scraps from replacing gaskets were in one drum; three other drums contained wastes of types listed in the previous section. No ignitable wastes were disposed of in the SI; as indicated in the previous section, the SI is never used for ignitable wastes.

No violations were noted at sites SI and DS.

Olin has made and continues to make every effort to reduce the quantity of waste generated, for reasons of both health and economics. The plant recovers the maximum possible amount of mercury in a retort furnace, for re-use. In addition,

Olin has a task force studying ways to reduce as much as possible the generation of mixed waste D001 paint and solvent, due to the present high cost of disposal.

Environmental personnel at Olin were very cooperative, and their objective, as stated by the plant manager following the exit interview, is to manage their hazardous wastes in full compliance with state and federal regulations in order to reduce as much as possible the risk to Olin employees and the public.

Suggestions were made regarding closure cost estimate, language, and a typographical error in the Part B application. See Recommendations below.

10) Conclusion

Olin Corporation, Charleston, Tennessee is in full compliance with all requirements of Tennessee Rule 1200-1-11-.05 and 40 CFR 265, which set interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities. Olin is also in full compliance with Tennessee Rule 1200-1-11-.03 and 40 CFR 262, which set standards applicable to generators of hazardous waste. The subparts of 40 CFR 265 that are applicable to Olin are A through I, and K; the corresponding paragraphs of Tennessee Rule 1200-1-11-.05 are (1) through (9), and (14).

11) Recommendations

The following suggestions were made:

(1) Jim Childress suggested that the closure cost estimate should be updated to reflect the ten-fold increase in the cost per 55-gal drum for disposal of mixed D001 paint and solvent waste. The current cost is $500 per drum.

(2) Javier Garcia suggested that the Part B application should be updated to indicate the current method of disposal of F001, F002 wastes.

(3) A typographical error in the Part B application was pointed out to Jack O'Grady, Environmental Process Engineer, a position formerly held by Bill Rankin, who was instrumental in preparing the Part B application.

12) Recommended Enforcement Action

None

13) Signed

Judy Sophianopoulos
Inspector

4/28/87
DATE

17 7 0047

14) Concurrence

Doyle T. Brittain
Chief, West Unit

Approval

Allan E. Antley, Chief
Waste Compliance Section

cc: Jim Childress, TDHE

Attachment A

Investigation needed for:

Unit	Ground water	Surface water	Soil	Air	Subsurface GOS	Other Actions
HTH Drying Pad	X	X	X			Determine any releases of hazardous waste constituents
Sump for over-chlorination	X					Check for construction. Submit design drawings. Submit maintenance schedule for tank inspection
Waste Oil Area						Submit source of waste oil
Main Sump	X					Check construction. Submit design drawings. Submit maintenance schedule for tank inspection.
Brine Muds Decant Pits	X			X		Submit construction of pits. Submit design drawings. Submit schedule for inspection for crocks.
Secondary Waste water Treatment Tanks	X	X	X			Check fittings and pump pumps. Submit tank inspection schedule andt. checklist.
Contaminated Rainfall/Run Off Tank System (Hg Cell Plant						Submit P & I diagram.
Contaminated Rainfall/Run Off Tank (Hg Cell Plant #2)						Submit P & I diagram.
Storage area (Salvage yard		X	X			Sample soil ditch.
Brine Muds Handling/De-watering Pads	X					Submit design drawings. Submit data on waste re removal practices. Submit inspection schedule checklist.
Sandblasting Painting Area			X			Sample soil.

Attachment B

Investigation needed for:

Unit	Ground water	Surface water	Soil	Air	Subsurface GOS	Other Actions
Misc. Disposal Area	X	X	X			Determine extent of contamination
South Disposal Area	X	X	X			Determine extent of contamination
East Disposal Area	X	X	X			Determine extent of contamination
Brine sludge Landfill	X	X	X			Determine extent of contamination
HTH Landfill	X	X	X			Determine extent of contamination

Site:
Break: 12.2
Other:

HgX® Mercury Decontaminant Powder

17 7 0050

ACTON TECHNOLOGIES, INC.

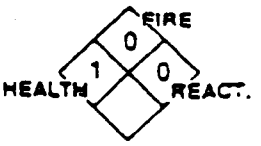
100 THOMPSON ST. P.O. BOX 726 PITTSTON PA 18640 U.S.A. PHONE (717) 654-0612 FAX (717) 654-2810

MATERIAL SAFETY DATA SHEET

SECTION I PRODUCT IDENTIFICATION

PRODUCT NAME:	HgX® Mercury Decontaminant Powder
MANUFACTURER'S NAME:	Acton Technologies, Inc.
CHEMICAL FAMILY:	Salt / Chelating Agent
FORMULA:	Proprietary Blend of Sodium Thiosulfate and Ethylenediaminetetraacetic Acid

HAZARD RATING



SECTION II HAZARDOUS INGREDIENTS

NONE

SECTION III PHYSICAL DATA

VAPOR DENSITY:	Not Applicable	PERCENT VOLITILE:	Not Applicable
SOLUBILITY IN H_2O:	Appreciable	SPECIFIC GRAVITY:	Est. above 1.0 (No Data)
EVAPORATION RATE:	Not Applicable	ODOR:	None
APPEARANCE:	Granular (white)		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:	Not Applicable	AUTO-IGNITION TEMPERATURE:	Not Applicable
FLAMMABLE LIMITS IN AIR:	Not Flammable	EXTINGUISHING MEDIA:	Not Applicable

FIRE FIGHTING PROCEDURES: Extremely high temperatures may cause evolution of toxic SO_2 or H_2S gases.

SECTION V HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE DATA: Not Applicable

EFFECT OF OVEREXPOSURE: None Known

FIRST AID PROCEDURES:

INHALATION: Avoid breathing dust by wearing dust respirator. Remove to fresh air if effects occur.

EYES: Irrigate eyes for 15 minutes. For serious irritation, seek medical attention.

SKIN: Flush skin with water for 15 minutes. For serious irritation, seek medical attention

INGESTION: Ingestion in gross quantities could be harmful - seek medical attention.

17 7 0051

Form Approved OMB No. 2070-0093
Approval Expires 01/91
(Page 1 of 5)

(Important: Type or print; read instructions before completing form.)

U.S. Environmental Protection Agency

EPA TOXIC CHEMICAL RELEASE INVENTORY REPORTING FORM

EPA FORM R

Section 313, Title III of The Superfund Amendments and Reauthorization Act of 1986

(This space for EPA use only.) 1988 5

Site:
Break: 17.7
Other: 6/30/88

PART I. FACILITY IDENTIFICATION INFORMATION

1. 1.1 Does this report contain trade secret information? ☐ Yes (Answer 1.2) ☒ No (Do not answer 1.2)
1.2 Is this a sanitized copy? ☐ Yes ☐ No
1.3 Reporting Year: 1987

2. CERTIFICATION (Read and sign after completing all sections.)

I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data available to the preparers of this report.

Name and official title of owner/operator or senior management official: M. S. Davenport, Plant Manager

Signature: M. S. Davenport
Date signed: June 30, 1988

3. FACILITY IDENTIFICATION

3.1 Facility or Establishment Name: Olin Corporation, Charleston Facility
Street Address: Lower River Road
City: Charleston
County: Bradley
State: Tennessee
Zip Code: 37310

3.2 This report contains information for: (check one)
a. ☒ An entire covered facility.
b. ☐ Part of a covered facility.

3.3 Technical Contact: J. P. Newman
Telephone Number (include area code): (615) 336-4234

3.4 Public Contact: M. S. Davenport
Telephone Number (include area code): (615) 336-4212

3.5 a. SIC Code: 2812 b. 2819 c.

3.6 Latitude: Deg. 035 Min. 18 Sec. 30 Longitude: Deg. 084 Min. 46 Sec. 50

3.7 Dun & Bradstreet Number(s): a. 00133 7292 b.

3.8 EPA Identification Number (RCRA I.D. No.): a. TND003337292 b.

3.9 NPDES Permit Number(s): a. TN0002461 b.

Where to send completed forms:
U.S. Environmental Protection Agency
P.O. Box 70267
Washington, DC 20024-0266
Attn: Toxic Chemical Release Inventory

3.10 Name of Receiving Stream(s) or Water Body(s):
a. Hiwassee River
b.
c.

3.11 Underground Injection Well Code (UIC) Identification No.: NA

4. PARENT COMPANY INFORMATION

4.1 Name of Parent Company: Olin Corporation

4.2 Parent Company's Dun & Bradstreet No.: 00133 8086

EPA Form 9350-1 (1-88)

17 7 0052

Page 2 of 5

EPA FORM R
PART II. OFF-SITE LOCATIONS TO WHICH TOXIC CHEMICALS ARE TRANSFERRED IN WASTES

1. PUBLICLY OWNED TREATMENT WORKS (POTW)

Facility name: N A

Street address:

City: | County:

State: | Zip:

2. OTHER OFF-SITE LOCATIONS - Number these locations sequentially on this and any additional pages of this form you use

[1] Other off-site location

EPA identification number (RCRA ID No.): K,Y,D,0,0,5,3,9,6,2,4,6

Facility name: Olin Chemicals - Doe Run Facility

Street address: Highway 933

City: Brandenburg | County: Meade

State: Kentucky | Zip: 4,0,1,0,8

Is location under control of reporting facility or parent company? [X] Yes [ ] No

[2] Other off-site location

EPA identification number (RCRA ID No.): A,L,D,0,0,6,2,3,4,6A

Facility name: Chemical Waste Management

Street address: Highway 17

City: Emelle | County: Sumter

State: Alabama | Zip: 3,5,4,5,9

Is location under control of reporting facility or parent company? [ ] Yes [Y] No

[ ] Other off-site location

EPA identification number (RCRA ID No.):

Facility name:

Street address:

City: | County:

State: | Zip:

Is location under control of reporting facility or parent company? [ ] Yes [ ] No

[ ] Check if additional pages of Part II are attached

17 7 0053

(Important: Type or print; read instructions before completing form.)

(This space for EPA use only.)

EPA FORM R
PART III. CHEMICAL SPECIFIC INFORMATION

1. CHEMICAL IDENTITY

1.1 [ ] Trade Secret (Provide a generic name in 1.4 below. Attach substantiation form to this submission.)

1.2 CAS # 0 0 1 7 4 5 9 - 9 7 - 6 (Use leading zeros if CAS number does not fill space provided.)

1.3 Chemical or Chemical Category Name: Mercury

1.4 Generic Chemical Name (Complete only if 1.1 is checked.)

2. MIXTURE COMPONENT IDENTITY (Do not complete this section if you have completed Section 1.)

Generic Chemical Name Provided by Supplier (Limit the name to a maximum of 70 characters to g., numbers, letters, spaces, punctuation).

3. ACTIVITIES AND USES OF THE CHEMICAL AT THE FACILITY (Check all that apply.)

3.1 Manufacture: a. [ ] Produce b. [ ] Import c. [ ] For on-site use/processing d. [ ] For sale/distribution e. [ ] As a byproduct f. [ ] As an impurity

3.2 Process: a. [ ] As a reactant b. [ ] As a formulation component c. [ ] As an article component d. [ ] Repackaging only

3.3 Otherwise Used: a. [X] As a chemical processing aid b. [ ] As a manufacturing aid c. [ ] Ancillary or other use

4. MAXIMUM AMOUNT OF THE CHEMICAL ON SITE AT ANY TIME DURING THE CALENDAR YEAR

0 6 (enter code)

5. RELEASES OF THE CHEMICAL TO THE ENVIRONMENT

You may report releases of less than 1,000 lbs. by checking ranges under A.1.		A. Total Release (lbs/yr) A.1 Reporting Ranges 0	1–499	500–999	A.2 Enter Estimate	B. Basis of Estimate (enter code)	C. % From Stormwater
5.1 Fugitive or non-point air emissions	5.1a				1046	5.1b 0	
5.2 Stack or point air emissions	5.2a				477	5.2b M	
5.3 Discharges to water (Enter letter code from Part I Section 3.10 for stream(s).) 5.3.1 [ ]	5.3.1a				23	5.3.1b M	5.3.1c 21
5.3.2 [ ]	5.3.2a					5.3.2b [ ]	5.3.2c
5.3.3 [ ]	5.3.3a					5.3.3b [ ]	5.3.3c
5.4 Underground injection	5.4a				0	5.4b M	
5.5 Releases to land 5.5.1 D 0 2 (enter code)	5.5.1a				10,777	5.5.1b M	
5.5.2 (enter code)	5.5.2a					5.5.2b [ ]	
5.5.3 (enter code)	5.5.3a					5.5.3b [ ]	

[ ] (Check if additional information is provided on Part IV-Supplemental Information.)

EPA FORM R, Part III (Continued) 17 7 0054 Page 4 of 5

6. TRANSFERS OF THE CHEMICAL IN WASTE TO OFF-SITE LOCATIONS

	A. Total Transfers (lbs/yr) A.1 Reporting Ranges	A.2 Enter Estimate	B. Basis of Estimate (enter code)	C. Type of Treatment/Disposal (enter code)
6.1 Discharge to POTW		0	6.1b M	
6.2 Other off-site location (Enter basis number from Part I, Section 2)		0	6.2b M	6.2c
6.3 Other off-site location (Enter basis number from Part I, Section 2)			6.3b	6.3c
6.4 Other off-site location (Enter basis number from Part I, Section 2)			6.4b	6.4c

☐ (Check if additional information is provided on Part IV-Supplemental Information)

7. WASTE TREATMENT METHODS AND EFFICIENCY

A. General Wastestream (enter code)	B. Treatment Method (enter code)	C. Range of Influent Concentration (enter code)	D. Sequential Treatment? (check if applicable)	E. Treatment Efficiency Estimate	F. Based on Operating Data? Yes	No
7.1a K	7.1b C 0 2	7.1c 3	7.1d	7.1e 99 %	7.1f XX	
7.2a S	7.2b F 2 9	7.2c 2	7.2d	7.2e 95 %	7.2f XX	
7.3a	7.3b	7.3c	7.3d	7.3e %	7.3f	
7.4a	7.4b	7.4c	7.4d	7.4e %	7.4f	
7.5a	7.5b	7.5c	7.5d	7.5e %	7.5f	
7.6a	7.6b	7.6c	7.6d	7.6e %	7.6f	
7.7a	7.7b	7.7c	7.7d	7.7e %	7.7f	
7.8a	7.8b	7.8c	7.8d	7.8e %	7.8f	
7.9a	7.9b	7.9c	7.9d	7.9e %	7.9f	
7.10a	7.10b	7.10c	7.10d	7.10e %	7.10f	
7.11a	7.11b	7.11c	7.11d	7.11e %	7.11f	
7.12a	7.12b	7.12c	7.12d	7.12e %	7.12f	
7.13a	7.13b	7.13c	7.13d	7.13e %	7.13f	
7.14a	7.14b	7.14c	7.14d	7.14e %	7.14f	

☐ (Check if additional information is provided on Part IV-Supplemental Information.)

8. OPTIONAL INFORMATION ON WASTE MINIMIZATION

(Indicate actions taken to reduce the amount of the chemical being released from the facility. See the instructions for coded items and an explanation of what information to include.)

A. Type of modification (enter code)	B. Quantity of the chemical in the wastestream prior to treatment/disposal: Current reporting year (lbs/yr)	Prior year (lbs/yr)	Or percent change	C. Index	D. Reason for action (enter code)
M	10,777		83 %	1 0	R 2

EPA Form 9350-1 (1-88)

(Instructions: Type or print. Read instructions before completing form.) 17 7 0055 Page 5 of 5

EPA FORM R
PART IV. SUPPLEMENTAL INFORMATION

(Use this section if you need additional space for answers to questions in Parts I and III. Number or letter this information sequentially from prior sections (e.g., D, E, F, or 5.54, 5.55).)

(This space for EPA use only.)

ADDITIONAL INFORMATION ON FACILITY IDENTIFICATION (Part I - Section 3)

3.5	S.C. Code	
3.7	D&B Dun & Bradstreet Number(s)	
3.8	EPA Identification Number(s) (RCRA I.D. No.)	
3.9	NPDES Permit Number(s)	
3.10	Name of Receiving Stream(s) or Water Body(s)	

ADDITIONAL INFORMATION ON RELEASES TO LAND (Part III - Section 5.5)

Releases to Land	A. Total Release (lbs/yr)	A.1 Reporting Ranges (0 / 1-499 / 500-999)	A.2 Enter Estimate	B. Basis of Estimate (enter code)
5.5.___ (enter code)	5.5.___a			5.5.___b
5.5.___ (enter code)	5.5.___a			5.5.___b
5.5.___ (enter code)	5.5.___a			5.5.___b

ADDITIONAL INFORMATION ON OFF-SITE TRANSFER (Part III - Section 6)

	A. Total Transfers (lbs/yr)	A.1 Reporting Ranges (0 / 1-499 / 500-999)	A.2 Enter Estimate	B. Basis of Estimate (enter code)	C. Type of Treatment/Disposal (enter code)
6.___ Discharge to POTW	6.___a			6.___b	
6.___ Other off-site location (Enter block number from Part II, Section 2.)	6.___a			6.___b	6.___c
6.___ Other off-site location (Enter block number from Part II, Section 2.)	6.___a			6.___b	6.___c

ADDITIONAL INFORMATION ON WASTE TREATMENT (Part III - Section 7)

A. General Wastestream (enter code)	B. Treatment Method (enter code)	C. Range of Influent Concentration (enter code)	D. Sequential Treatment? (check if applicable)	E. Treatment Efficiency Estimate	F. Based on Operating Data? Yes	No
7.___a	7.___b	7.___c	7.___d	7.___e %	7.___f	
7.___a	7.___b	7.___c	7.___d	7.___e %	7.___f	
7.___a	7.___b	7.___c	7.___d	7.___e %	7.___f	
7.___a	7.___b	7.___c	7.___d	7.___e %	7.___f	
7.___a	7.___b	7.___c	7.___d	7.___e %	7.___f	

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17 7 0056

Site:
Break: 12.7
Other: Jan. 1987

Cleanup of Mercury Contamination of Thermometer Workers' Homes

JOHN ZIRSCHKY[A] and LINDEN WITHERELL[B]

[A]ERM-Southeast, Inc., 2629 Sandy Plains Road, Suite 201, Marietta, GA 30066; [B]Vermont State Health Department, P.O. Box 70, Burlington, VT 05402

Several incidents of contamination of the home with chemicals from the workplace have been reported in recent years. Employees at a mercury thermometer plant transported mercury from the factory into their homes. As a result, increased levels of mercury were found in the urine of some of the employees' families. Thus, a home cleaning program was instituted. In this paper, a discussion of the cleaning procedures used and the problems encountered during the home cleaning program is presented. The decontamination procedures used depended upon the levels of mercury detected using a mercury vapor analyzer. Cleaning procedures used included vacuuming with a mercury vacuum system and cleaning with a mercury binding solution. If mercury was not detectable at a concentration of 1 $\mu g/m^3$ in the air, then the cleaning was assumed to be complete. All contaminated cleaning liquids and supplies were disposed of as hazardous wastes. Most of the problems experienced were related either to administrative procedures or public perception. The greatest administrative problem was identifying employees who wished to participate in the cleaning program. Two regulatory agencies, the employees' union, the industry, and the cleaning coordinator all kept separate lists of employees wishing to participate. Cross-referencing the separate lists proved difficult, especially since some employees changed their minds several times. Because of inaccurate newspaper accounts and the fact that the cleanup operations took place in a small town, public perception of the cleaning program was a problem. The cleaning operations were thus highly visible and provided ample opportunity for rumor propagation.

Introduction

In recent years it has become increasingly apparent that contamination of the home with chemicals from the workplace can occur, and that such contamination can pose a health risk to workers and their families. Incidents of contamination of the home with lead have been reported.[1,2] Addressing home contamination can be a very difficult problem from both a technical and human point of view. The contamination must be removed without unnecessarily disrupting the lives of the occupants. In this paper, a brief overview of the methodology utilized and the problems encountered during a recent home decontamination project are discussed.

Background

The Division of Environmental Health (DEH) of the Vermont Department of Health (VDH) became concerned about the possibility of mercury from a clinical thermometer plant being unintentionally carried on the clothing of workers to their homes with subsequent contamination of their homes and resultant adverse effects on their children. In the spring of 1984, the VDH contacted the union representing the workers and obtained its cooperation in an environmental health survey of the workers' homes and health monitoring of their children. The studies found elevated air mercury vapor levels in some of the workers' homes and elevated urine mercury levels in some of the children.

As a result of these findings, the VDH ordered the plant closed on June 8, 1984 and, as more information became available concerning the extent of the contamination of workers' homes, issued another health order on August 15, 1984, requiring the company to undertake cleanup of the workers' homes. Because several of the workers lived in New York State, the VDH worked in cooperation with the New York State Department of Health (NYSDH) to require the cleanup of workers' homes located in New York State.

Initial Cleanup Operations

Initially, supervisory personnel from the company directed the cleanup operations in workers' homes. Although the industry did successfully clean several homes, some employees and their union questioned the ability of the industry to properly execute such a cleaning program because of problems experienced in one home. Extreme difficulty was encountered by the company in cleaning this one home, thereby forcing the displacement of the family for several weeks. Numerous attempts were made to clean up this home, however, subsequent inspections by the VDH consistently showed the presence of mercury. Both the industry and the VDH used a Jerome Model 411 mercury vapor analyzer for their inspections.

Because of these problems, the VDH issued a health order on November 16, 1984, requiring the company to retain the services of a professional firm with expertise in mercury decontamination to undertake cleanup of the workers' homes. In December 1984, Environmental Resources Management-Southeast, Inc. (ERM-SE) was contracted by the company and approved by the VDH, which also consulted with the NYSDH and local union representatives.

Subsequent Cleanup

The first phase of the project for ERM-SE consisted of decontaminating the home in which the industry had experienced problems. The family had been displaced for several weeks, and a high priority was given to completing the decontamination so that the family could return to their home by Christmas. During this decontamination, every exposed surface of the home was washed or dusted. In addition, all dishware, pottery, appliances, and similar personal effects also were cleaned. To minimize the intrusion into the lives of the family, personal items within drawers except kitchen items, and closets were not cleaned. After two days, most of the home had been decontaminated. An inter

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im monitoring by the VDH then showed that primarily personal effects, such as clothing, were still contaminated. All such items were laundered or allowed to air. Approximately two more days were required to complete the decontamination of this two bedroom apartment.

Protocol

The next phase of the project consisted of developing a written protocol to be used for all subsequent home decontaminations. Included in this protocol were descriptions of all cleaning procedures to be used, the disposition of all waste materials, the personnel to be used on the project, and procedures for ensuring that each home was properly decontaminated. A draft of this protocol was circulated for comment to the VDH, NYDH, and UFWA, and the industry. During the course of the project revisions were made to this protocol. The major elements of this protocol are outlined briefly in the following:

Interested Parties and Responsibilities

The employees, their union, the industry, the states' health departments, and ERM-SE were the interested parties. The employees were responsible only for providing access to their homes, while the union was responsible for identifying employees who wished to participate in the project. The industry provided all resources necessary to complete the project, and the health departments were responsible for ensuring all homes were decontaminated. ERM-SE was responsible for directing the decontamination operations.

Personnel

Three personnel positions were involved in the project: an administrative secretary, the cleaning personnel, and the on-scene coordinator. The administrative secretary was supplied by the union and was responsible for contacting the employees to determine who wished to participate in the decontamination and to make cleaning appointments with interested employees. The cleaning personnel performed the decontamination under the supervision of the on-scene coordinator.

Personnel Safety and Training

Prior to work in any homes, the cleaning workers were given an orientation to the project including a discussion of exposure routes, the toxicity of mercury, the protective equipment to be used, recommended personal hygiene practices, and cleaning procedures. A pre- and post-project physical also was given to all workers.

Monitoring

A Jerome Model 411 mercury vapor analyzer was used to monitor the air in the homes before, during, and after cleaning. The level of detection for the instrument was 1 $\mu g\ m^{-3}$, which also was the standard for clean up (see clean up criteria following). To prevent false positive readings at this low level, two positive readings out of four attempts at 1 $\mu g\ m^{-3}$ at one location were required to indicate contamination. Any reading above 1 $\mu g\ m^{-3}$ was accepted without retrial.

Cleanup Criterion

In order for a home to be considered clean, no detectable mercury concentrations in the air of the home or automobiles could be present. In addition, mercury should not be detectable in washing machines, vacuum cleaners, or shoe soles. A concentration of 1 $\mu g\ m^{-3}$ of mercury (the U.S. Environmental Protection Agency's suggested ambient air criteria) was chosen as the acceptable detection limit and was thus the clean up criterion. If mercury was not detected in the home prior to cleaning, the employee still had the option of having the home cleaned. If detectable mercury concentrations were found, decontamination continued until mercury could not be detected by both ERM-SE and the VDH.

Cleaning Procedures

The cleaning procedures used in the homes of employees depended upon the levels of mercury detected. No protocol, however detailed, could encompass every situation which could be encountered. If no detectable mercury concentrations were found in a home, minimal cleanup procedures were used. They consisted primarily of cleaning sink traps and vacuuming the home with a Nilfisk vacuum. The purpose of cleaning plumbing fixtures was to prevent additional mercury from entering the sewer system (high levels of mercury were found in the sludge at the local wastewater treatment plant) and to prevent any mercury present in the traps from volatilizing into the home.

The clean up procedures to be used when detectable mercury levels were found depended upon the extent of contamination. If the mercury contamination was localized (*e.g.*, dust under a refrigerator), then cleaning procedures more extensive than vacuuming were utilized in those areas. A general overview of the cleaning procedures is presented in the following:

Vacuuming

All floors in a home, including closet floors were vacuumed with a Nilfisk mercury vacuum system. The floors under furniture were vacuumed unless the homeowner did not want furniture moved, or movement of the furniture could injure workers or damage the furniture. If contamination was present and the furniture had to be moved to eliminate the contamination, the latter exception did not apply.

Plumbing Traps

Plumbing traps (*e.g.*, sink trap) were cleaned either by removal of the plumbing fixtures or by placing a mercury cleaning solution (HgX) in the drain and pumping out the drain. A visible accumulation of elemental mercury was found in one bathtub trap.

Washing Machines

If detectable mercury concentrations were found, HgX was placed in the machine during the wash cycle. The wash and rinse waters then were collected and treated as a hazardous waste. A few washing machines were too contaminated to be cleaned either in this manner or by taking the machine apart and cleaning all parts by hand. Such machines were replaced.

Shoes

The soles of shoes were cleaned with a HgX solution.

Personal Possessions

During the cleanup it was necessary to remove some personal possessions from homes. For example, contaminated clothes were taken to a laundry and cleaned. The disposition of other items was determined on a case-by-case basis. Airing these items and allowing the mercury to volatilize was a common cleaning technique. Some personal items such as rugs were replaced.

Vacuum Cleaners

Vacuum cleaners were decontaminated in the home, by 1) discarding of the vacuum cleaner bag as contaminated material, 2) rinsing the easily accessible parts of the vacuum with an HgX solution, and 3) removing any dust from the vacuum attachments. Replacement parts, primarily hoses, sometimes were required.

Waste Disposal

All contaminated cleaning materials were delivered to the company in plastic bags for disposal at an approved industrial waste disposal site. Liquid wastes were delivered in 55-gallon drums.

Problems Encountered

Few technical problems were encountered during the decontamination program. Nearly all of the difficulties experienced were related to administrative procedures, public perception or public relations. Instrument sensitivity was the only major technical difficulty experienced. The air standard of 1 $\mu g/m^3$ equaled the sensitivity of the monitoring equipment. Occasionally, false positive readings were obtained; thus, at least two positive readings in four attempts were required to confirm contamination at levels of 1 $\mu g/m^3$. Furthermore, the decontamination operation was conducted in winter with outside air temperatures occasionally below zero. Many homes had wood-burning stoves, resulting in interior temperatures of > 90°F in some rooms, while other rooms were not heated. Unless sufficient time was allotted for the instrument temperature to stabilize, very high false positive readings could be obtained when moving from a hot room to a cold room. Whenever possible, workers were asked to heat all rooms prior to monitoring.

Administrative problems related mainly to ensuring that all employees who wished to participate in the decontamination operation were encountered. Several employees initially agreed or disagreed only to later change their minds, which created some confusion as all parties kept a separate list. Each person wishing to participate was checked and cross-checked by the VDH/NYDH, the industry, UFWA, and ERM-SE. In one case, the landlord of one employee requested that the home be cleaned even though the employee could not be contacted for permission and had previously refused entry. Potential legal problems were averted when the VDH agreed to monitor this home under their regulatory authority. No contamination was found and the home was not cleaned.

The industry was located in a small town in a rural area, making rumors a problem during the operation. The decontamination operation provided ample opportunity for rumor propagation. Examples of rumors about the project personnel ranged from cruelty to animals to illicit sexual relations. Inaccurate newspaper accounts of the mercury contamination assisted in rumor propagation and may have impeded progress in the operation, with such things as "itai-itai" (a disease related to arsenic exposure) and secret hazardous waste dumps reported.

Another major problem during the project was employee perception of the adequacy of the decontamination procedures. The techniques used were proven to be adequate in all homes, although, return spot cleanings were necessary in a few instances. Because of the simplicity of the operations, local people were hired to perform the actual decontamination. Some employees, however, expected men in "moonsuits" with complicated technical equipment. Local people were not perceived by some to have technical expertise to perform a thorough decontamination (housecleaning). Although the cleaning personnel were adequate for the operation, in future similar instances it may be advantageous to use non-local people.

At the time the home decontamination program was being conducted, the industry also was involved with decontamination of the factory and of the local wastewater treatment plant. Different state agencies were responsible for overseeing each of the three decontamination programs. While generally in agreement, the requirements and priorities of the three agencies were not always consitent or well coordinated.

Summary and Conclusions

In summary, few technical problems were experienced in the decontamination program, and all homes were successfully decontaminated. Public perception and employee relations, however, presented some difficulties. To decrease such difficulties on future decontamination operations, the following recommendations are proposed. First, when home contamination is discovered, decontamination should be initiated as soon as possible. Second, notifying the industry of any suspected home contamination prior to notifying the media or other parties could help in gaining the industry's cooperation. Third, because of the complex legal issues involved, funds and enabling legislation should be available for the appropriate state agency to initiate emergency response activities. Sufficient time should be allotted, however, to develop reasonable procedures before beginning decontamination. Fourth, if the industry undertakes the decontamination, an independent party should direct the project to avoid the appearance of a conflict of interest. Fifth, a written protocol outlining all administrative and decontamination procedures should be prepared and distributed to all interested parties (*e.g.*, employees' representative, regulatory agencies) for review and modification. Procedures for modifying this protocol during the course of a cleaning program also should be established. Once the protocol has been

agreed upon, the interested parties should not publicly express reservations about the procedures used so as not to undermine the operation and discourage participation, and sixth, when more than one regulatory agency is involved, a lead agency should be designated to ensure maximum coordination of all participants and to minimize confusion.

Awareness of home contamination is increasing due to such factors as right-to-know laws and media coverage. A good industrial hygiene program can reduce, if not eliminate, the potential for home contamination. Thus, a review of industrial hygiene practices also is recommended.

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17 7 0060

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Superfund and Contamination of Workers' Homes

J. ZIRSCHKY[A], B. GENTRY[B] and P. MARCUS[C]
[A]RM-Southeast, Inc., 2629 Sandy Plains Rd., Suite 201, Marietta, GA 30066; [B]Goodwin, Procter and Hoar, Exchange Place, Boston, MA 02109;
[C]ERM, Inc., 999 West Chester Pike, West Chester, PA 19381

Introduction

In the 1970s, it became increasingly apparent that improper disposal of hazardous wastes was a significant environmental problem in many parts of the United States. In response to this problem, Congress passed the Resource Conservation and Recovery Act[1] (RCRA) in 1976 and the Comprehensive Environmental Response, Compensation and Liability Act[2] (CERCLA, or more commonly, Superfund) in 1980.

The primary intent of the Superfund Program is to provide a regulatory framework and funds for cleaning up the nation's uncontrolled hazardous waste sites. As a result, Superfund often is thought of solely in the context of waste disposal. Several incidents of contamination of workers' homes with chemicals from the workplace recently have been reported.[3-5] In these instances, existing control practices did not prevent small quantities of chemicals from inadvertently being transported out of the factories and into the workers' homes.

At least one state government is attempting to recover the costs of investigating a home contamination problem by using Superfund. Thus, an industry with a good history of waste disposal becomes involved with Superfund as a result of control practices previously thought adequate. Industrial hygienists, therefore, should be familiar with the Superfund Program. A brief overview of the Superfund legislation with emphasis on how inadequate industrial hygiene practices could result in a Superfund lawsuit is presented herein. Several more detailed summaries of the Superfund program are available, including Reference 6.

The Superfund Program

Legislation

In 1980, Congress passed the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA, or more commonly, Superfund). CERCLA provides the federal government with the authority to clean up releases of hazardous substances (most typically from closed or abandoned disposal sites), to carry out investigations, to test and monitor sites, and to implement clean-up procedures. The mechanisms to be used to conduct these activities are described in the National Contingency Plan[7] (NCP; 40 *CFR* 300). The scope of Superfund recently was expanded by the Superfund Amendment and Reauthorization Act of 1986 (SARA). A $9 billion dollar fund for the next five years was authorized by SARA.

This fund may be used for a number of specific activities, including the following: 1) the costs of assessing both long- and short-term damage resulting from the release of a hazardous substance into the environment; 2) the costs of a program to identify, investigate, and take enforcement and abatement actions in response to such a release; 3) the costs of epidemiologic and health assessment studies; 4) reimbursement to local governments for temporary emergency measures, 5) rewards to individuals who provide information leading to the arrest of person(s) violating criminal provisions of the Act; and 6) the cost of carrying out a lead poisoning study relating to lead poisoning in children. In the case of one home contamination incident, the state is arguing that Superfund monies also may be used to respond to or investigate potential environmental releases resulting from inadequate industrial hygiene practices.

Liability

CERCLA Section 107 provides that the owners and operators of facilities at which hazardous substances have been released — as well as transporters and generators of any hazardous substances — shall be liable for all costs incurred in responding to a release of hazardous substances sent to the facilities. Courts have interpreted this liability provision very broadly, such that the plaintiff (either the government or a private party) in a Section 107 cost recovery suit need not show, as a condition to recovery, any fault on the part of the defendants.

In order to prevail in a CERCLA Section 107 cost recovery action, the plaintiff has to show a release or threatened release of a hazardous substance from a facility which causes the incurrence of response costs.

CERCLA defines, and courts have interpreted, each of these elements of a cost recovery action very broadly.

Release or Threatened Release

CERCLA Section 101(22) initially defined release as "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment." CERCLA Section 101(2), defining "release," was expanded under SARA to include specifically "abandonment or discarding of barrels, containers and other closed receptacles containing any hazardous substance or pollutant or contaminant." Thus, for example, abandoned, closed barrels need not actually be leaking in order to constitute a release. In one home contamination incident, the state has alleged that the small quantities of a process chemical that left the factory on the workers' clothing constituted a release. It also should be noted, however, that CERCLA excludes from the definition of a "release" "any release which results in exposure to persons solely within a workplace."

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Hazardous Substance

CERCLA Section 101(14) defines hazardous substance to include the following:

- any Resource Conservation and Recovery Act (RCRA) hazardous waste;
- any toxic pollutant or hazardous chemical substance under Sections 307 and 311 of the Clean Water Act (CWA)[8];
- any imminently hazardous chemical substance under Section 7 of the Toxic Substances Control Act (TSCA)[9];
- any hazardous air pollutant listed under Section 112 of the Clean Air Act (CAA)[10]; or
- any substance designated by the EPA under Section 102 of CERCLA.

A large number of materials are thus covered under CERCLA.

Facility

CERCLA defines the term "facility" broadly in Section 101(9). In fact, courts have held that a facility under CERCLA "includes every place where hazardous substances come to be located." In the home contamination case, the state is arguing that the workers' homes should be defined as CERCLA facilities. This interpretation, however, goes well beyond the normal Superfund case where hazardous substances have been released at a site and have migrated through the soil and water present at the site.

Response Cost

The incurrence of some response costs, such as the costs incurred in studying and clearing up a site, is required as a prerequisite to liability under Section 107. The government need not have completed its cleanup, however, before it can sue.

CERCLA does not state explicitly whether its provisions apply to the disposal of hazardous waste that occurred before its enactment (11 December 1980). Nonetheless, courts have held that defendants are liable, retroactively, for the results of such conduct and that such liability is not unconstitutional. Accordingly, disposal practices which may have been entirely lawful at the time they were undertaken may subject an industry to CERCLA liability.

There are two broad categories of costs for which defendants in CERCLA actions may be liable: response costs; and damage to natural resources. Response costs may include the costs associated with the following: investigating, monitoring, testing and evaluating the site; conducting a health assessment or health effects study; planning and implementing the response action; and litigation by the EPA and the Department of Justice. CERCLA also authorizes the Agency for Toxic Substances and Disease Registry to conduct medical testing and surveys to determine any relationship between illness and exposure to the toxic substances that have been released. The state involved in the home contamination case now is seeking to recover, under Superfund, the costs of the blood testing of workers and their families that was conducted to document exposure and home contamination.

Available Defenses

Section 107 and other provisions of CERCLA provide a limited group of defenses to liability and now set forth a standard of review against which administrative action can be challenged. In addition, certain other defenses based on considerations of fairness (equitable defenses), as well as a defense based on the Federal Constitution, also might be raised.

Section 107(b) provides that a person who would otherwise be liable can defend himself or herself by showing that the damages resulting from a release were caused solely by the following:

1. an act of God;
2. an act of war;
3. a third party who is neither an employee of the defendant nor someone who is in a contractual relationship with the defendant, as long as the defendant has exercised due care with respect to the hazardous substance, and as long as the defendant took reasonable precautions against the acts of such a third party; and
4. any combination of the foregoing three factors.

These defenses are known as "affirmative defenses", which mean that the defendant bears the burden of proof with respect to each.

Several other possible statutory defenses may exist. For example, the defendant may be able to show that the actions undertaken or desired by the government are inconsistent with the National Contingency Plan. Another possible defense would be to show that the conditions in a home or homes do not constitute a "substantial danger to present or future public health or welfare or the environment" [CERCLA Section 101(24)]. The applicability of these defenses to an incident of home contamination has yet to be tested in the courts.

The Clean-up Process

The CERCLA clean-up process is set forth in the National Contingency Plan (NCP). The NCP provides for discovery and listing of Superfund sites, site studies, development of clean-up alternatives, choice of a remedy, and implementation of that remedy.

Clean-up actions can be either short-term (removal actions) or long-term (remedial actions).

Several significant changes were made to CERCLA by the 1986 amendments including:

- a requirement that remedial actions meet the most stringent federal and state requirements that are applicable or relevant and appropriate;
- a directive that EPA choose permanent remedies whenever possible; and
- an expansion of the involvement of states and citizens' groups in the development and choice of remedies.

Removal Actions

Removal actions are short-term or temporary response actions taken to alleviate more immediate and significant risks posed by a site.

CERCLA defines removal as follows:

1. the cleanup or removal of released hazardous substances from the environment;
2. the actions necessary to monitor, assess and evaluate the release or threat of release of hazardous substances; and
3. the disposal of removed material or the taking of such actions as necessary to protect public health or welfare or the environment.

In 40 *CFR* 300.65, EPA indicates the factors that will be considered when determining whether removal actions are required:

1. actual or potential exposure to hazardous substances;
2. actual or potential contamination of drinking water or sensitive ecosystems;
3. hazardous substances or pollutants in drums, *etc.*, which pose a threat of release;
4. pollutants or contaminants at or near the surface that may migrate;
5. conditions that may cause hazardous substances, pollutants or contaminants to migrate or be released; and
6. threat of fire or explosion.

Contamination of a worker's home could represent an actual exposure to hazardous substances. At least one state has [illegible]idered its response to such a situation to be CERCLA [illegible]al action.

[illegible]

[illegible] its second of two options for cleaning up a hazardous waste site. EPA can, under CERCLA Section 104, clean up a site on its own and then sue private parties under Section 107 to recover its costs. Alternately, under Section 106, EPA can file a lawsuit or issue an administrative order to compel a private party to conduct the cleanup itself. EPA even could resort to the use of both sections in a single lawsuit by ordering, for instance, the defendants to reimburse EPA for the cost of studying the site, while ordering the defendants to [illegible]

The use of Section 106 [illegible] ing private parties to undertake the cleanup. Its use by EPA, however, is limited by at least two factors:

- it is often difficult to locate responsible parties who are capable of performing a clean-up operation; and
- it is limited to emergency situations.

A major change to CERCLA Section 106 made by the 1986 amendments involves the extent to which a responsible party can obtain judicial review of a Section 106 clean-up order prior to the time the order is enforced. CERCLA Section 113(h)(2) now provides that a federal court may review a [illegible]-up order issued under Section 106 only at a time an [illegible]n is brought by EPA to enforce that order or to recover a penalty for violation of that order. In addition, new CERCLA Section 106(b)(2) provides for reimbursement from the Superfund under certain circumstances for persons who comply with Section 106(a) orders. Finally, settlements involving private party studies and cleanups of releases now are expressly encouraged by CERCLA.

The prerequisite to injunctive relief or to an administrative order under Section 107 is an administrative determination that an "actual or threatened release of a hazardous substance from a facility may" present "an imminent and substantial endangerment to the public health or welfare or the environment."

Courts have not yet addressed the issue of whether contamination of a home with chemicals from the workplace potentially could meet these criteria.

Defenses to Section 106 Liability

A number of courts have held that actions under Section 106 are subject to the same defenses as actions under Section 107. Equitable defenses – such as "laches" or "unclean hands" – also may be available. A defendant also could attempt to limit his or her liability under Section 106 by arguing that there is no "imminent and substantial endangerment" or that the remedy proposed by the government is as follows: unnecessary to abate the risk; inconsistent with the NCP; or ineffective, unfeasible or impractical. No court yet has had an opportunity to deal with these issues.

Sanctions for Failure to Comply with Section 106 Orders

Failure to comply with a judicial decree under Section 106 may result in sanctions for contempt of court. Failure to abide by an administrative order under Section 106 "without [illegible]" may result in punitive damages of up to [illegible] government as a result of such failure [Section 107(c)(3)]. Failure to abide by a Section 106 order also may result in a $5,000 fine for each day in which the failure occurs [Section 106(b)].

Section 106, however, recently was amended by SARA in an effort to address some of the perceived unfairness of its penalty provisions. It now provides that a person is liable only for daily penalties for violation of Section 106(a) administrative orders if such person "without sufficient cause, [illegible] such an order [Section 106(b)(1)]. Thus, the new amendments provide a good [illegible] imposition of daily penalties for failure to comply with a Section 106(a) order. Even more significantly, Section 106(b)(2) has been added to provide, under certain circumstances, reimbursement from the fund to individuals complying with an order under Section 106(a). Reimbursement is appropriate where the individual can show the following:

- that he or she is not liable for response costs under Section 107 (see Liability), and that his or her costs incurred in complying with the order were reasonable; or
- where the clean-up order is arbitrary, capricious and not in accordance with the law.

Cost Recovery Process

As initially enacted – other than the broad liability provisions of Section 107 – CERCLA did not contain detailed provisions on the process by which the government may recover its costs under Superfund. In particular, CERCLA did not specify any procedure for negotiated settlements among parties to a cost recovery action. Instead, the EPA issued guidance documents that governed the settlement process. The 1986 amendments, however, now set forth a detailed settlement procedure which EPA may use.

As soon as the government has taken any response action at a site, the cost recovery process can begin. This process has two stages:

1. the identification and discovery of information from potentially responsible parties (PRPs) and the reciprocal discovery of information from the government; and
2. either a binding settlement between the PRPs and the government allocating liability for response costs and containing releases from future liability, or if no settlement is reached, litigation between the government and the PRPs can be conducted.

Past experience with Superfund sites has shown that private party cleanups often cost two-thirds of a government cleanup. From a clean-up cost standpoint, negotiated settlements where the PRPs conduct the actual cleanup are often more economical.

Summary

Although originally conceived as a means to clean up abandoned hazardous waste sites, at least one state is now attempting to use the Superfund (CERCLA) legislation as a means to recover the costs of a home contamination incident. This case has not been litigated yet. If the state is successful, however, the Superfund program would be expanded not only to cover waste disposal practices but also industrial hygiene practices. Industries thus need to review the nature and disposition of their waste material and their industrial hygiene practices in order to assess their full potential exposure under Superfund. The small amounts of chemicals that may leave a factory on workers' clothing and shoes someday could develop into a costly home decontamination project.

If a review of past and present industrial hygiene practices reveals that home contamination could have occurred, an industry should take an offensive (as opposed to defensive) role in correcting the problem. Not only can taking the initiative in remedying a problem help minimize damage to employee health, morale and public opinion, but clean-up costs can be reduced as well without sacrificing the quality of the remedial action.

References

1. **Resource Conservation and Recovery Act:** Title 42 U.S. Code, Section 6901 *et seq.*
2. **Comprehensive Environmental Response, Compensation and Liability Act:** Title 42 U.S. Code, Section 9601 *et seq.*
3. **Baker, E.L., D.S. Folland, M. Frank, G. Lovejoy, J. Houswort and P.J. Landriga:** Lead Poisoning in Children of Lead Workers: Home Contamination and Industrial Dust. *N. Engl. J. Med. 296*:260-261 (1977).
4. **Zirschky, J. and L.E. Witherell:** Cleanup of Mercury Contamination of Thermometer Workers' Homes. *Am. Ind. Hyg. Assoc. J. 48*:81-84 (1986).
5. **Watson, W.N., L.E. Witherell and G.C. Giguere:** Increased Lead Absorption in Children of Workers in a Lead Storage Battery Plant. *J. Occup. Med. 20*:759-761 (1978).
6. **Environmental Resources Management, Inc.**, West Chester, Pa., and Goodwin, Procter, and Hoar, Boston, Mass. *The New Superfund: CERCLA Amendments of 1986 — Managing Superfund's Costs and Liabilities.* West Chester, Pa.: Environmental Resources, Inc.
7. "National Contingency Plan," *Code of Federal Regulations* Title 40, Pt. 300.
8. **Clean Water Act:** Title 33 U.S. Code, Section 1251 *et seq.*
9. **Toxic Substances Control Act:** Title 15 U.S. Code, Section 2601 *et seq.*
10. **Clean Air Act:** Title 42 U.S. Code, Section 7401 *et seq.*

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV, ATHENS, GEORGIA

Site: _____
Break: 17.2
Other: _____

MEMORANDUM

17 7 0064

DATE: JUL 10 1989

SUBJECT: TVA Fish Tissue Data Review

FROM: William R. Davis William R. Davis
Hazardous Waste Section
Environmental Compliance Branch
Environmental Services Division

TO: James D. Kopotic
Emergency Response and Control Section
Site Investigation and Support Branch
Waste Management Division

THRU: M. D. Lair, Chief
Hazardous Waste Section
Environmental Compliance Branch
Environmental Services Division

I have reviewed the subject data and offer the following comments.

The data was collected from 1981 through 1987 and must be compared with that in mind. There are stations that are not identified by location and, therefore, are not discussed relative to the Olin Chemical Corporation at river mile (RM) 16.0 on the Hiwassee River.

The nearest data station was either RM 14 or I-75 bridge, whichever is the closest to the discharge from Olin at RM 15.8; both are downstream from the Olin discharge. The highest concentration for mercury in fish (largemouth bass) was 0.55 mg/kg. The mean value for seven fish was 0.49 mg/kg. This data originated from fish taken on August 4, 1982, at the I-75 bridge.

Rm 14 fish contained an average of 0.34 mg/kg of mercury for largemouth bass and 0.40 mg/kg for catfish. These data were obtained from fish collected during June 11, 1987.

Highway 58 bridge is located downstream from RM 14; the mean concentration for largemouth bass was 0.23 mg/kg. This data was obtained from fish collected during August 4, 1982. More data was generated from fish collected on June 8, 1983. Catfish and golden redhorse mercury concentrations were less than 0.1 mg/kg and 0.14 mg/kg, respectively.

RM 5.0, in the upper reach of the Chickamauga Reservoir contained a mean concentration of less than one mg/kg of mercury for 5 largemouth bass; five catfish averaged less than one mg/kg, and five carp averaged less than one mg/kg.

Fish were collected from reservoir systems around the State of Tennessee, analyzed for mercury, and that data was tabulated. Elk River fish from Wheeler Reservoir contained 0.20 mg/kg for catfish, 0.45 mg/kg for largemouth bass, and 0.49 mg/kg for smallmouth bass. Nottely Reservoir bass contained 0.37 mg/kg of

mercury. Little Tennessee River, Fontana Reservoir, catfish contained 0.22 mg/kg and 0.59 mg/kg in different parts of the lake. Another lake, John Sevier Detention Reservoir, had bass with mercury concentrations of 0.27 mg/kg, catfish with 0.38 mg/kg, and carp with 0.24 mg/kg of mercury.

In summary, when comparing the data in fish from many reservoirs from around the state of Tennessee, it becomes apparent that there are many river/lake systems that have a background residual of mercury in fish. However, the fish collected downstream from Olin are noticeably higher in mercury concentrations.

cc: Finger/Patton
Lair/Hall

17 7 0066

Site:
Break: 12.7
Other:

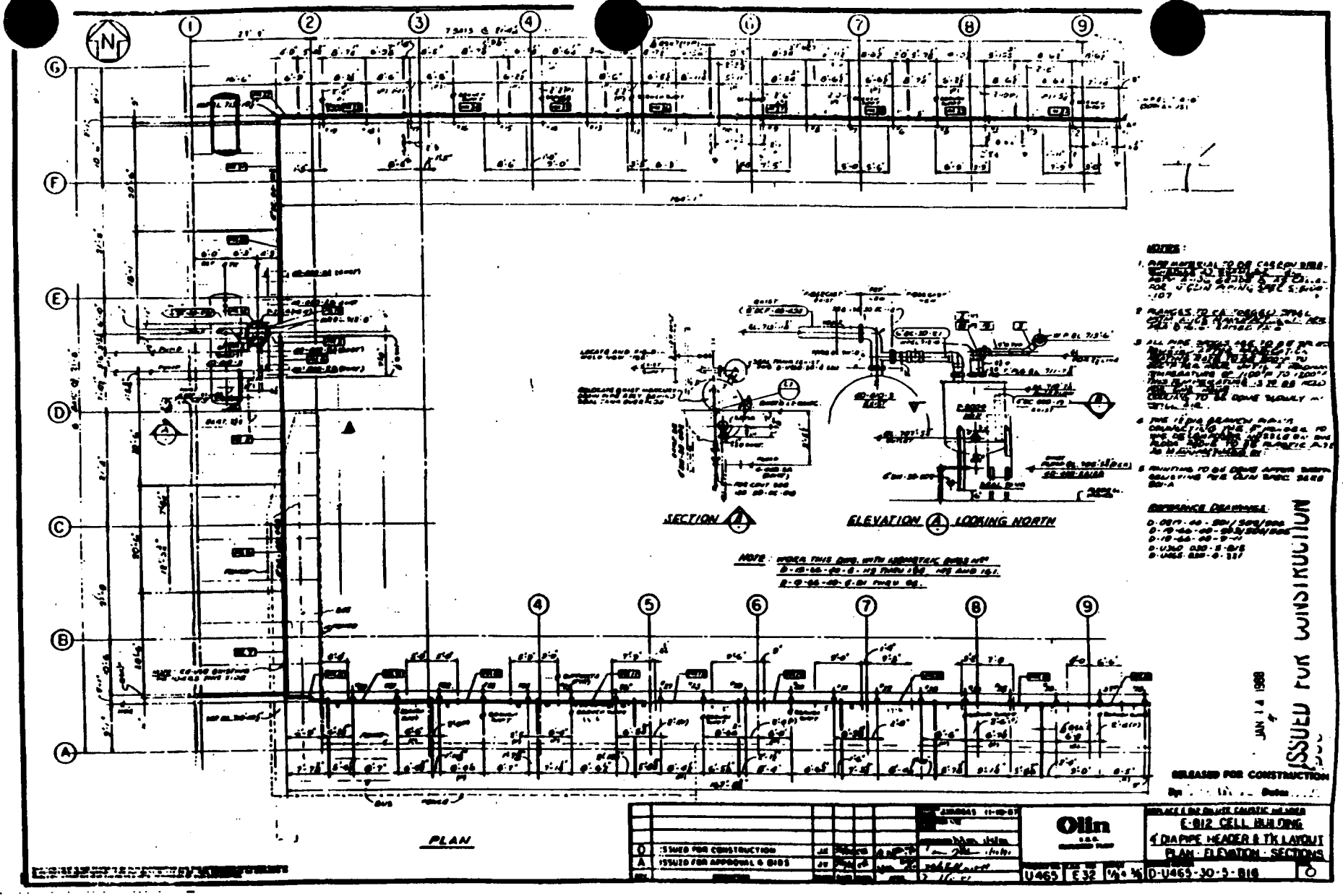
E-812 CHLORINE PLANT SHUTDOWN

AUGUST 22, 1988 MONDAY

OBJECTIVES OF SHUTDOWN

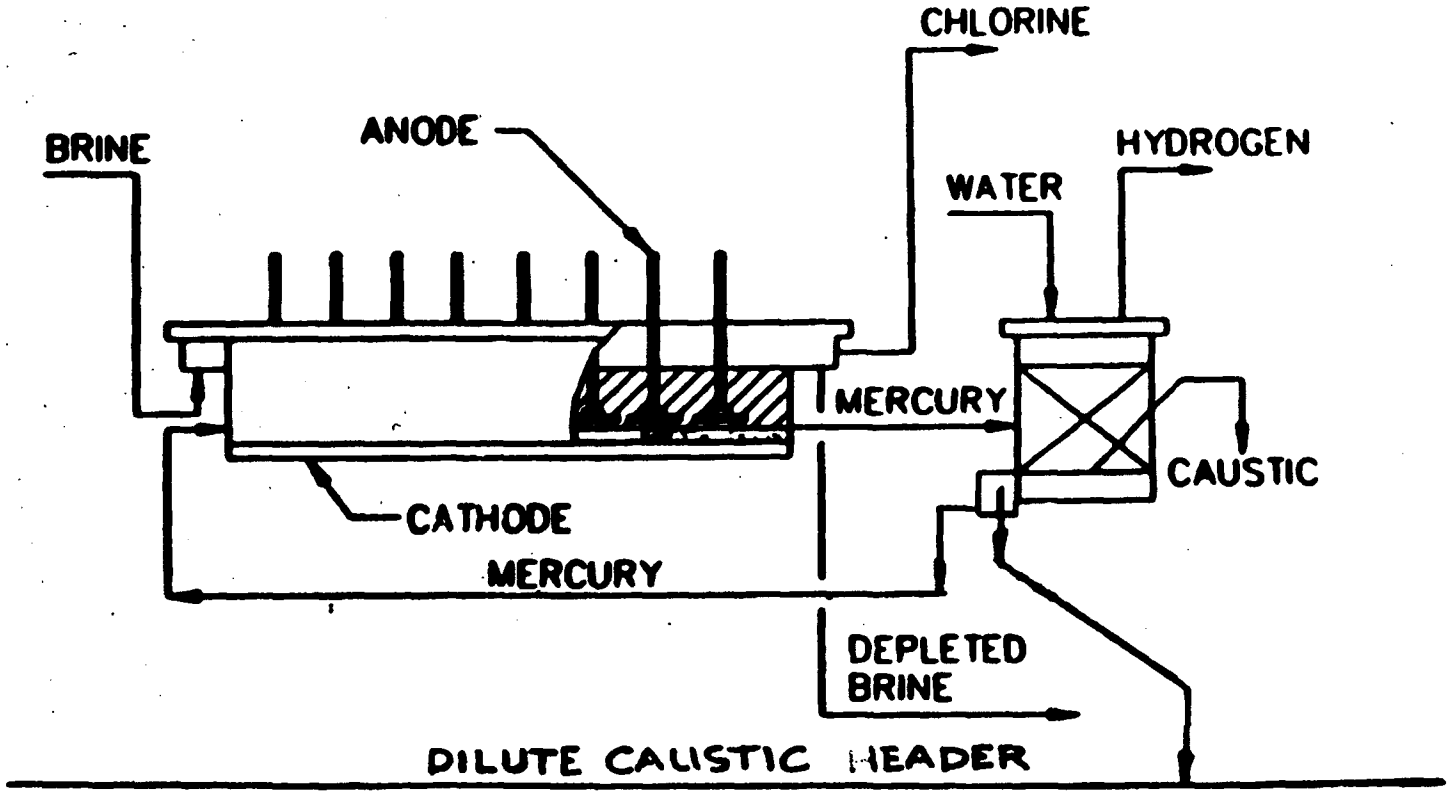
1. INSTALL BRINE FLASH TANK
2. REPLACE BRINE PIPING (FIBERGLASS)
3. REPLACE DILUTE CAUSTIC HEADER AND TANK
4. REPLACE 50% CAUSTIC SURGE TANK
5. SG-6 ELECTRICAL WORK
6. MISCELLANEOUS MAINTENANCE JOBS

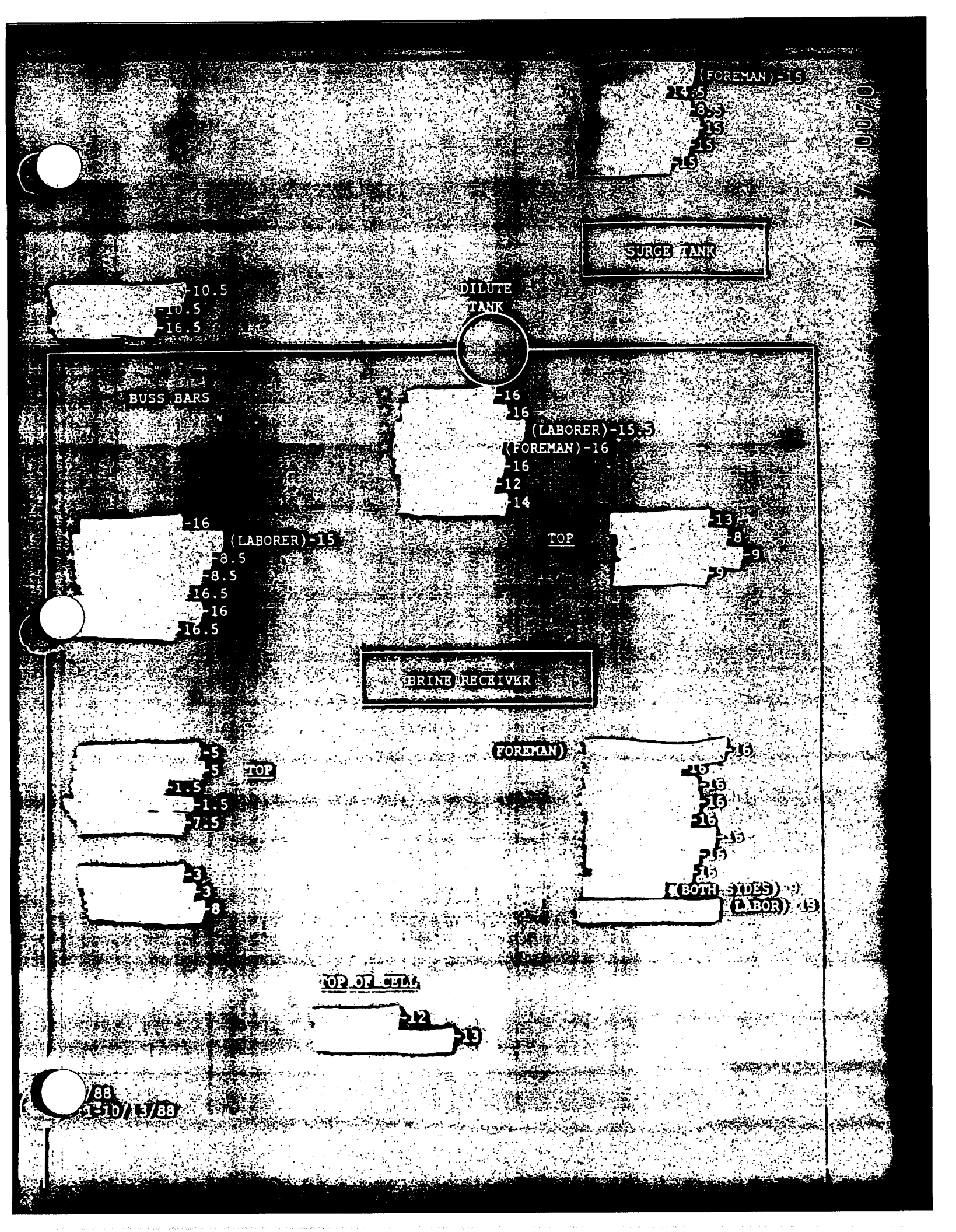
17 7 0067


PLAN
SECTION 4
ELEVATION 4 LOOKING NORTH
NOTES
REFERENCE DRAWINGS
ISSUED FOR CONSTRUCTION
RELEASED FOR CONSTRUCTION
JAN 14 1988
Olin
E-812 CELL BUILDING
4" DIAPHPE HEADER & TK LAYOUT
PLAN · ELEVATION · SECTIONS
U465
E32
D-U465-30-5-B18
0
ISSUED FOR CONSTRUCTION
ISSUED FOR APPROVAL & BIDS

17 7 0068

OLIN MERCURY CELL




(FOREMAN)-15
SURGE TANK
DILUTE TANK
BUSS BARS
(LABORER)-15.5
(FOREMAN)-16
(LABORER)-15
TOP
BRINE RECEIVER
(FOREMAN)
TOP
(BOTH SIDES)
(LABOR)
TOP OF CELL

CHRONOLOGICAL ORDER

E-812 SHUTDOWN

JULY 15 - PRE-CONSTRUCTION MEETING

AUGUST 19 - PRE-SHUTDOWN SAFETY MEETING - TEARGIN

AUGUST 22

7:00 Outage safety meeting held by Teargin

Mercury-in-air Survey

7:30 Checking area to begin issuing permits - Line Breaking, Hot Work, and High Work

Safety Orientation - New employees

8:30 Start demo Dilute Caustic Header

Start 50% Surge Tank Removal

Permit delayed due to high hydrogen

12:00 Mercury-in-air Survey _____

12:30 p.m. 50% Caustic tank tagged for removal

Outage Meeting Report

1:00 p.m. Removed old 50% NaOH Surge Tank - Slightly behind schedule

Dilute NaOH Header on schedule

1:30 p.m. Install 50% Surge Tank and start piping

2:00 p.m. Demo complete on dilute caustic header

3:00 p.m. All jobs on schedule except Flash Tank (Brine Area)

CHRONOLOGICAL ORDER - Page 2

E-812 Shutdown

Outage Report Meeting

6:00 p.m. Dilute piping one hour behind

7:30 p.m. Completed 50% Surge Tank piping

Crews shifted to Dilute Caustic Header

Downcomers were not matching header, due to prior decomposer switchouts and sandblast operation had destroyed some mark numbers during the painting preparations.

Searching for material to make-up new downcomers from decomposer misfits, one hour behind.

Outage Meeting Report

12:00 a.m. Finished NaOH Header

No mention of any illnesses by Yeargin employees.

Note: Three Yeargin men were washing down floors all day. Additionally, operators started washing down work areas in the afternoon.

AUGUST 23

7:00 a.m. - Cell building posted

7:30 a.m. - Pipe clean-up and removal. Operation started.

CHRONOLOGICAL ORDER - Page 3

E-812 SHUTDOWN

AUGUST 24

One man reported to Medical - sick - "didn't feel good".

AUGUST 25

[redacted] reported some sicknesses

Eight urinalyses completed.

Dr. Whittle called in.

Eight men reported to Medical.

Between August 25 and 29, eleven Yeargin employees reported to Medical and thereafter Yeargin's workers compensation carrier assumed responsibility for any medical treatment.

SEPTEMBER 30 - OCTOBER 11

Twenty-six homes were checked at the request of Yeargin.

SUMMARY - HOME SURVEY FOR MERCURY
REQUESTED BY YEARGIN
9/30/88 THRU 10/11/88

	Tested Positive	Total No. Tested
WASHING MACHINES	9	26
VACUUM CLEANER BAGS	5	20
WORK BOOTS (8/22/88)	4	21
VEHICLE	2	21
DIRTY LAUNDRY CONTAINERS	1	18

Items Collected - Tested Positive

Three Pair of Work Boots

Four Vacuum Cleaner Bags

One Truck Seat Cover

Notes: Yeargin replaced one vacuum cleaner.

SUMMARY BIOLOGICAL MONITORING

Yeargin Employee Number	Reported to Olin Medical	Urinary Mercury Levels									
		7/14	7/19	8/23	8/25	8/26	8/29	9/14	9/15	9/23	9/28
1	8/25/88	.033	-	.052	.043	-	.120	-	.064	-	-
2	8/25/88	-	-	-	.067	-	-	.067	-	-	-
3	8/25/88	-	-	-	.073	-	.074	.087	-	.055	-
4	8/25/88	-	.052	.054	.063	-	.087	.058	-	-	-
5	8/25/88	.031	-	.294	.122	-	.162	.231	-	-	-
6	8/25/88	.041	-	.350	.244	-	.231	.241	-	-	-
7	8/25/88	-	-	.180	.150	-	.173	.172	-	-	-
8	8/25/88	-	-	-	.031	-	.028	.017	-	.031	-
9	8/26/88	.015	.055	-	-	.185	.216	.168	-	-	-
10	8/26/88	-	-	-	-	.012	.210	.055	-	-	-
11	8/29/88	-	-	.098	-	-	.106	.105	-	-	-

jpn1128:bap

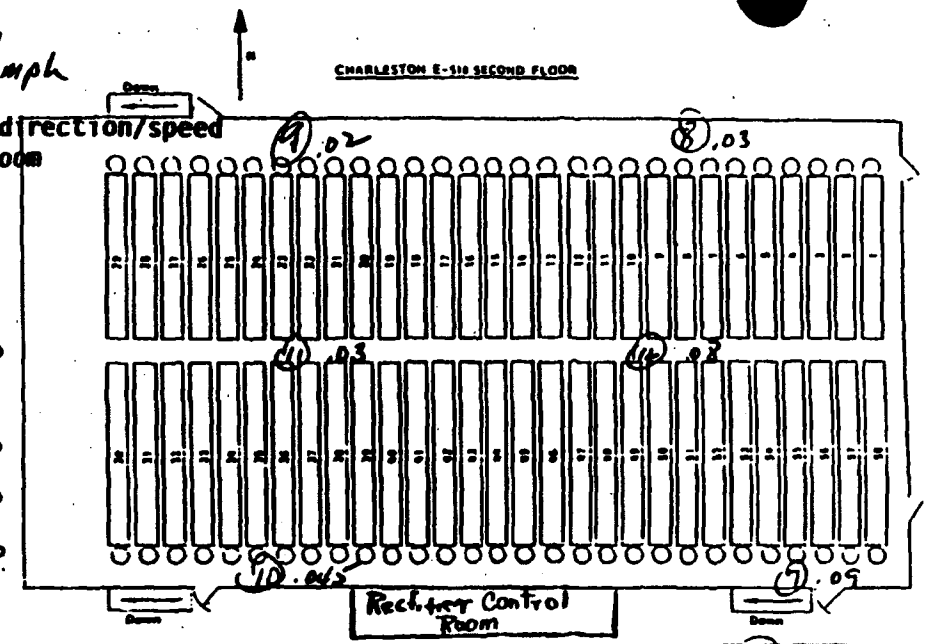
MERCURY IN AIR SURVEY - PORTABLE HG M[illegible]R - CHARLESTON PLANT

DATE: [illegible]-22-88 7

5 mph

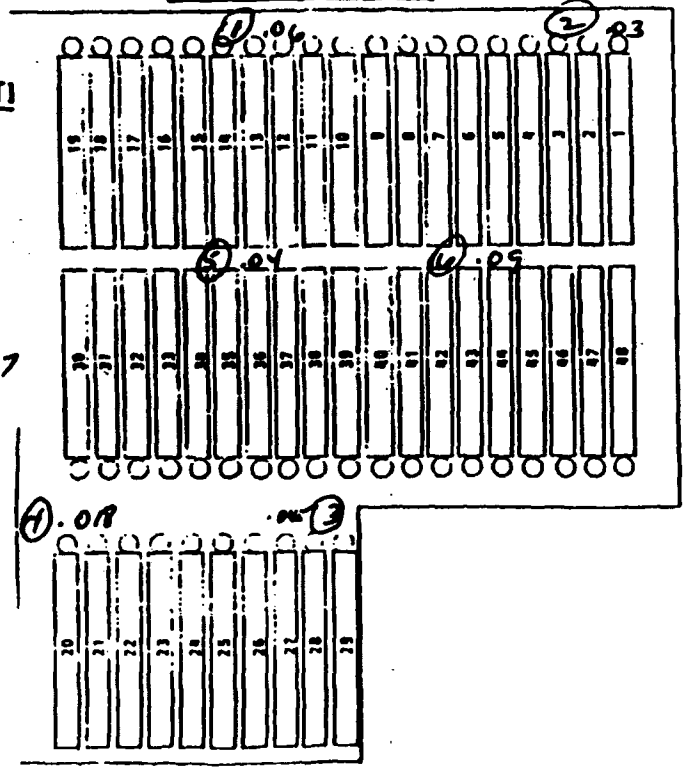
Wind direction/speed
cellroom
temp.

1. 28°
2. 29°
3. 27°
4. 24°
7. 30°
8. 36°
9. 35°
10. 41°



MERCURY IN AIR SAMPLE POINT LOCATI

1. .06
2. .03
3. .045
4. .018
5. .04
6. .09 AU .047
7. .09
8. .03
9. .02
10. .045
11. .03
12. .08 AU .049



COMMENTS

Basement

1. .035
2. .04
3. .018
4. .005
7. .06
8. .02
9. .01
10. .02

BY: C. A. Leese

17 7 0076

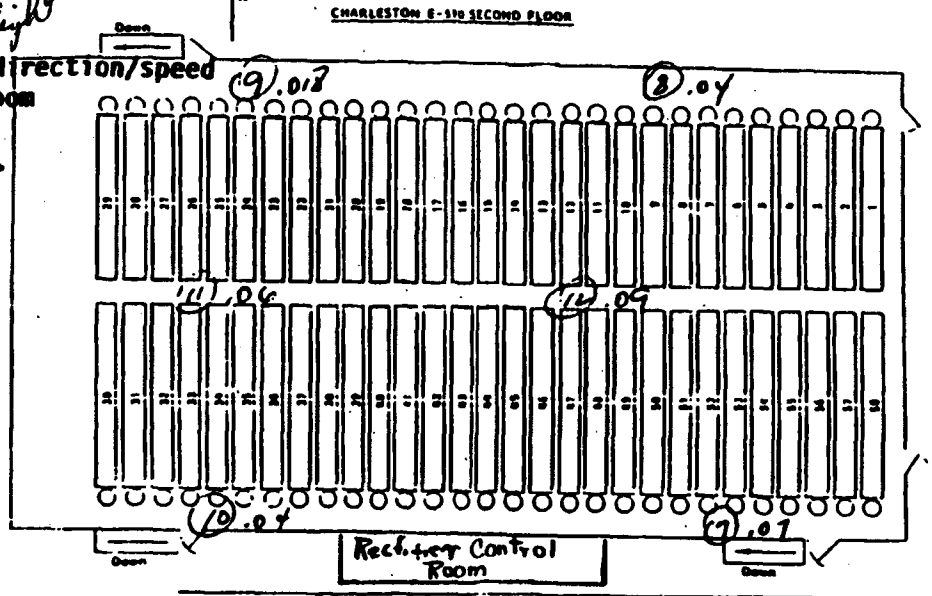
MERCURY IN AIR SURVEY - PORTABLE HG M[illegible]OR - CHARLESTON PLANT

DATE: 8-23-88

Slight

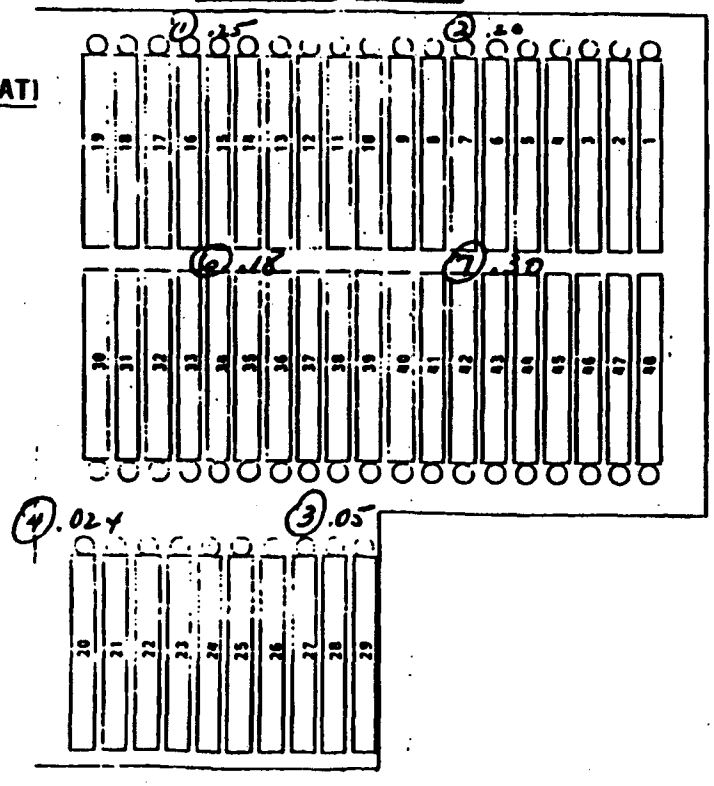
Wind direction/speed
cellroom
temp.

1. 25°
2. 25°
3. 20°
4. 24°
7. 25°
8. 41°
9. 40°
10. 42°



MERCURY IN AIR
SAMPLE POINT LOCATI

1. .25
2. .20
3. .05
4. .024
5. .18
6. .30
7. .07
8. .04
9. .018
10. .04
11. .06
12. .09



COMMENTS

Basement

1. .25
2. .05
3. .08
4. .018
7. .04
8. .03
9. .02
10. .04

BY: C. A. Pease

17 7 0077

State of Tennessee — Department of Public Health
Division of Solid Waste Management

17 8 0001

Report on Potential Hazardous Waste Disposal Facility

PART 1 - FACILITY INFORMATION AND ASSESSMENT

Site: ____
Break: 17.8
Other: ____

I. IDENTIFICATION

01 DISPOSAL FACILITY ID NO.: TND003337292

II. FACILITY NAME AND LOCATION

01 FACILITY NAME (Legal, common, or descriptive name of site): East Disposal Area

02 STREET, ROUTE NO. OR SPECIFIC LOCATION IDENTIFIER: Lower River Road

03 CITY: Charleston

04 STATE: TN | 05 ZIP CODE: 37310 | 06 COUNTY: Bradley | 07 COUNTY CODE:

08 COORDINATES — LATITUDE: 35 18 30 N | LONGITUDE: 084 46 40 W

09 DIRECTIONS TO FACILITY (Starting from nearest public road):
Starting at Charleston plant main entrance off Lower River Road, travel east approximately 400 yds. to East Disposal Area just north of Lower River Road.

III. RESPONSIBLE PARTIES

01 OWNER (If known): Olin Corporation

02 STREET: 120 Long Ridge Road

03 CITY: Stamford

04 STATE: CT | 05 ZIP CODE: 06904 | 06 TELEPHONE NUMBER: (203) 356-2000

07 OPERATOR (If known and different from owner): ---

08 STREET: ---

09 CITY: ---

10 STATE: -- | 11 ZIP CODE: --- | 12 TELEPHONE NUMBER: ( ) ---

13 TYPE OF OWNERSHIP (Check one):
☒ A. PRIVATE ☐ B. FEDERAL: ____ (Agency name) ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL
☐ F. OTHER: ____ (Specify) ☐ G. UNKNOWN

14 FACILITY STATUS (Check one): ☐ A. ACTIVE ☒ B. INACTIVE ☐ C. UNKNOWN

15 YEARS OF OPERATION: 1971 (BEGINNING YEAR) | 1973 (ENDING YEAR) ☐ UNKNOWN

IV. NOTIFIER INFORMATION

01 NOTIFIER NAME (Company name): Olin Corporation

02 STREET OR BOX NO.: P.O. Box 248

03 TELEPHONE NUMBER: (615) 336-2251

04 CITY: Charleston

05 STATE: TN | 06 ZIP CODE: 37310 | 07 COUNTY: Bradley

08 DATE: 5 / 20 / 82 (MONTH DAY YEAR)

09 CONTACT NAME: J.P. Newman

10 CONTACT TITLE: Manager, Product Quality and Environmental Control

11 SIC CODE AND DESCRIPTION LISTED:
2812 Alkalies and Chlorine; 2819 Industrial Inorganic Chemicals

12 BRIEF DESCRIPTION OF PRODUCTION PROCESS (ITEMS PRODUCED, ACTIVITIES INCLUDED, ETC.)
1. Manufacture chlorine and sodium hydroxide (caustic soda) using the mercury electrolytic cell process.
2. Manufacture sodium hydrosulfite (Reductone®) using the mercury, electrolytic cell process and chemical reaction process.
3. Manufacture calcium hypochlorite (HTH®) using a chemical reaction process.
4. Manufacture dry caustic soda by evaporation.

PART 2. INFORMATION CONCERNING WASTES DISPOSED AT REFERENCED FACILITY

I. WASTE STATES, QUANTITIES, AND CHARACTERISTICS AT TIME OF DISPOSAL

01 PHYSICAL STATES (Check all that apply):
☒ A. SOLID ☐ E. SLURRY
☐ B. POWDER, FINES ☐ F. LIQUID
☐ C. SLUDGE ☐ G. GAS
☒ D. OTHER: semi-solid (Specify)

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent):
TONS: ____
OR CUBIC YARDS: 6667
OR NO. OF DRUMS: ____

03 WASTE CHARACTERISTICS (Check all that apply):
☐ Ignitable ☐ Toxic
☐ Reactive ☒ EP Toxic
☐ Corrosive ☒ Other: K071; K106

04 DATES OF WASTE DISPOSAL BY NOTIFER AT ABOVE SITE: FROM 1962 TO 1982

Report on Potential Hazardous Waste Disposal Facility

PART 2 - WASTE INFORMATION—continued

I. IDENTIFICATION

01 DISPOSAL FACILITY ID NO TND003337292

II. HAZARDOUS WASTES (Reference Hazardous Waste Regulations for Code Numbers)

01 HAZARDOUS WASTE CODE	02 SUBSTANCE NAME	03 SOURCE OF WASTE (Activity Producing Waste)	04 TREATMENT METHOD (Ref. Process Codes)	05 STORAGE/DISPOSAL METHOD (Ref. Process Codes)	06 AMOUNT DISPOSED PER MONTH	07 UNIT OF MEASURE	08 CONCENTRATION AS DISPOSED	09 UNIT OF MEASURE
K071	Brine purification muds from the mercury cell process in chlorine production	Brine saturation and settling of impurities		D80	157	yd^3	5-100	ppm Hg
K106 *	Wastewater treatment sludge from the mercury cell process in chlorine production	Precipitation and filtration of HgS from wastewater		D80	2	yd^3	2000-10000	ppm Hg
D009	Misc. Hg-contaminated wastes	Misc. operations associated with mercury-cell process in chlorine production		D80	26	yd^3	50-5000	ppm Hg

* Essentially all of the Hg is tied up as HgS, a salt with low leachability. The process which produces this waste represents BAT.

TOTAL QUANTITY OF HAZARDOUS WASTE DISPOSED PER MONTH = 185 yd^3

PROCESS CODES:

Treatment	Code	Treatment	Code	Storage:	Code	Disposal:	Code
TANK	T01	OTHER (Also for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the process in the space provided. PART 2 III)	T04	CONTAINER (barrel, drum, etc)	S01	INJECTION WELL	D79
SURFACE IMPOUNDMENT	T02			TANK	S02	LANDFILL	D80
INCINERATOR	T03			WASTE PILE	S03	LAND APPLICATION	D81
				SURFACE IMPOUNDMENT	S04	OCEAN DISPOSAL	D82
				OTHER (Describe process in the space provided; Part 2 III)	S05	SURFACE IMPOUNDMENT	D83
						OTHER (Describe process in space provided; Part 2 III)	D84

Tennessee Department of Public Health — Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 2—WASTE INFORMATION—Continued 17 8 0003

I. IDENTIFICATION

01 FACILITY ID NO. TND003337292

III. EXPLANATION OF PROCESS CODES, PARTICULARLY "OTHER" CODES USED IN PART 2-II.

N/A

PART 3—DESCRIPTIVE INFORMATION

I. FACILITY DESCRIPTION

01 DESCRIPTION OF METHOD OF OPERATION, CLOSURE, COVER, ETC.

Landfill operation; facility closed in place with topsoil and seeded.

02 CURRENT USE AND SITE SECURITY (FENCING, LIGHTING, ETC.) WHERE APPLICABLE

No current use; secured by general plant security.

II. CONTAINMENT

01 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, LEACHATE COLLECTION AND TREATMENT SYSTEMS, ETC.

N/A

III. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE (exposed at surface)? ☐ YES ☒ NO

02 COMMENTS

PART 4—DEMOGRAPHIC, WATER, AND ENVIRONMENTAL DATA

I. DEMOGRAPHIC AND PROPERTY INFORMATION

01 ESTIMATED TOTAL POPULATION

A. Residents within ¼ mi. radius 2 B. Residents within 1 mi. radius 16 C. No. Employees on site 818

02 PROVIDE USGS TOPOGRAPHIC MAP FOR 1 MI. RADIUS OF FACILITY SHOWING THE FOLLOWING. See attachment III

a. 20 ft. contours
b. existing roads, buildings and other major structures
c. drinking water intakes (both groundwater and surface water)

II. GROUNDWATER See attachment I

01 GROUNDWATER USE IN VICINITY (Check as applicable)

☐ A. ONLY SOURCE FOR DRINKING ☐ B. DRINKING (Other sources available) ☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available) ☐ D. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available) ☐ E. NOT USED, UNUSEABLE

02 POPULATION WITHIN 1 MI. RADIUS OF FACILITY WHICH IS SERVED BY GROUND WATER ____ (estimate)

03 DISTANCE TO NEAREST DOWN GRADIENT DRINKING WATER WELL ____ (mi) (approximate)

04 DEPTH TO UPPERMOST AQUIFER (ft)	05 DIRECTION OF UPPERMOST AQUIFER FLOW	06 DEPTH TO AQUIFER OF CONCERN (ft)	07 POTENTIAL YIELD OF AQUIFER (gpd)	08 SOLE SOURCE AQUIFER
				☐ YES ☐ NO

Tennessee Department of Public Health — Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 4—WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA 17 8 0004

I. IDENTIFICATION

01 FACILITY ID NO. TND003337292

[illegible]UNDWATER—Continued

09 DESCRIPTION OF WELLS (including usage, depth, and location—latitude and longitude—within 1 mi. radius)

10 RECHARGE AREA
- ☐ YES
- ☐ NO

COMMENTS

11 DISCHARGE AREA
- ☒ YES
- ☐ NO

COMMENTS Based on discharge to ri[illegible]

III. SURFACE WATER

01 SURFACE WATER USE (Check one)

- ☒ A. RESERVOIR, RECREATION DRINKING WATER SOURCE
- ☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES
- ☐ C. COMMERCIAL, INDUSTRIAL
- ☐ D. NOT CURRENTLY USED

02 POTENTIALLY AFFECTED BODIES OF WATER

NAME:	DISTANCE TO SITE
Hiwassee River	1/2 (mi)
	(mi)
	(mi)

IV. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one) No data

- ☐ A. 10^{-6} to 10^{-4} cm/sec
- ☐ B. 10^{-4} to 10^{-2} cm/sec
- ☐ C. 10^{-2} to 10^{-1} cm/sec
- ☐ D. GREATER THAN 10^{-1} cm/sec

02 PERMEABILITY OF BEDROCK (Check one) No data

- ☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec)
- ☐ B. RELATIVELY IMPERMEABLE (10^{-6} to 10^{-2} cm/sec)
- ☐ C. RELATIVELY PERMEABLE (10^{-2} to 10^{-1} cm/sec)
- ☐ D. VERY PERMEABLE (Greater than 10^{-1} cm/sec)

[illegible] TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
unknown (ft)	unknown (ft)	unknown

06 NET PRECIPITATION/YEAR	07 TEN YEAR 24 HOUR RAINFALL	08 SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
52 (in)	6 (in)	0-1 %	ESE	0-1 %

09 FLOOD POTENTIAL

FACILITY IS IN >500 YEAR FLOOD PLAIN

10 DISTANCE TO WETLANDS (5 acre minimum) unknown (mi)

11 DISTANCE TO CRITICAL HABITAT (of endangered species) _____ (mi)

ENDANGERED SPECIES: unknown

12 DESCRIPTION OF FACILITY IN RELATION TO SURROUNDING TOPOGRAPHY

Facility follows natural terrain contours and features

V. PHOTOGRAPHS (Provide copies if readily available)

01 TYPE ☐ GROUND ☐ AERIAL

[illegible]
[illegible]OTO DATE _____
[illegible]OTO DATE _____

02 IN CUSTODY OF _____
(Name of organization and individual contact)

Address: _____

Phone No _____

Tennessee Department of Public Health — Division of Solid Waste Management

Potential Hazardous Waste Disposal Facility

PART 5—SAMPLE AND FIELD INFORMATION 17 8 0005

I. IDENTIFICATION
01 FACILITY ID NO. TND003337292

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 BRIEF SUMMARY OF ANALYTICAL RESULTS	03 SAMPLING DATES
GROUNDWATER	0		
SURFACE WATER	0		
AMBIENT AIR	0		
METHANE	0		
RUNOFF	0		
SOIL	0		
VEGETATION	0		
OTHER	0		

III. OTHER FIELD DATA COLLECTED (Provide field measurements and narrative description of other field data)

NONE

PART 6—OFF-SITE GENERATOR INFORMATION

I. OTHER GENERATORS WITHIN NOTIFIER'S COMPANY DISPOSING AT THIS FACILITY

01 NAME: N/A	02 D + B NUMBER	01 NAME: N/A	02 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY: N/A / 06 STATE	07 ZIP CODE	05 CITY: N/A / 06 STATE	07 ZIP CODE
01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE

PART 7—SOURCES OF INFORMATION FOR THIS REPORT (Cite specific references, e.g., company files, sample analysis, results)

Plant records
State Hazardous Waste Generator Notification
Personal Interviews
Superfund Section 103(c) Notification

State of Tennessee — Department of Public Health
Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 1 - FACILITY INFORMATION AND ASSESSMENT 17 8 0006

I. IDENTIFICATION
01 DISPOSAL FACILITY ID NO. TND003337292

II. FACILITY NAME AND LOCATION

01 FACILITY NAME (Legal, common, or descriptive name of site): South Disposal Area	02 STREET, ROUTE NO. OR SPECIFIC LOCATION IDENTIFIER: Lower River Road

03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE
Charleston	TN	37310	Bradley	

08 COORDINATES — LATITUDE: 35 18 30 N | LONGITUDE: 084 46 40 W

09 DIRECTIONS TO FACILITY (Starting from nearest public road):
Starting at Charleston plant main entrance off Lower River Road, travel approximately 200 yds. east to South Disposal Area just south of Lower River Road.

III. RESPONSIBLE PARTIES

01 OWNER (If known): Olin Corporation	02 STREET: 120 Long Ridge Road

03 CITY	04 STATE	05 ZIP CODE	06 TELEPHONE NUMBER
Stamford	CT	06904	(203) 356-2000

07 OPERATOR (If known and different from owner): ---	08 STREET: ---

09 CITY	10 STATE	11 ZIP CODE	12 TELEPHONE NUMBER
---	--	----	(--)------

13 TYPE OF OWNERSHIP (Check one)
- [x] A. PRIVATE
- [ ] B. FEDERAL: _____ (Agency name)
- [ ] C. STATE
- [ ] D. COUNTY
- [ ] E. MUNICIPAL
- [ ] F. OTHER: _____ (Specify)
- [ ] G. UNKNOWN

14 FACILITY STATUS (Check one)
- [ ] A. ACTIVE
- [x] B. INACTIVE
- [ ] C. UNKNOWN

15 YEARS OF OPERATION: 1962 (BEGINNING YEAR) | 1971 (ENDING YEAR) [ ] UNKNOWN

IV. NOTIFIER INFORMATION

01 NOTIFIER NAME (Company name): Olin Corporation	02 STREET OR BOX NO.: P.O. Box 248	03 TELEPHONE NUMBER: (615) 336-2251

04 CITY	05 STATE	06 ZIP CODE	07 COUNTY	08 DATE
Charleston	TN	37310	Bradley	5 / 20 / 82 (MONTH DAY YEAR)

09 CONTACT NAME: J.P. Newman	10 CONTACT TITLE: Manager, Product Quality and Environmental Control

11 SIC CODE AND DESCRIPTION LISTED
2812 Alkalies and Chlorine; 2819 Industrial Inorganic Chemicals

12 BRIEF DESCRIPTION OF PRODUCTION PROCESS (ITEMS PRODUCED, ACTIVITIES INCLUDED, ETC.)
1. Manufacture chlorine and sodium hydroxide (caustic soda) using the mercury electrolytic cell process.
2. Manufacture sodium hydrosulfite (Reductone®) using the mercury, electrolytic cell process and chemical reaction process.
3. Manufacture calcium hypochlorite (HTH®) using a chemical reaction process.
4. Manufacture dry caustic soda by evaporation.

PART 2. INFORMATION CONCERNING WASTES DISPOSED AT REFERENCED FACILITY

I. WASTE STATES, QUANTITIES, AND CHARACTERISTICS AT TIME OF DISPOSAL

01 PHYSICAL STATES (Check all that apply)
- [x] A. SOLID
- [ ] B. POWDER, FINES
- [ ] C. SLUDGE
- [ ] D. OTHER semi-solid (Specify)
- [ ] E. SLURRY
- [ ] F. LIQUID
- [ ] G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)
TONS _____
OR CUBIC YARDS 13,520
OR NO. OF DRUMS _____

03 WASTE CHARACTERISTICS (Check all that apply)
- [ ] Ignitable
- [ ] Reactive
- [ ] Corrosive
- [ ] Toxic
- [x] EP Toxic
- [x] Other K071

04 DATES OF WASTE DISPOSAL BY NOTIFER AT ABOVE SITE: FROM 1962 TO 1982

Report on Potential Hazardous Waste Disposal Facility

PART 2 - WASTE INFORMATION—continued

I. IDENTIFICATION

01 DISPOSAL FACILITY ID NO TN003337292

II. HAZARDOUS WASTES (Reference Hazardous Waste Regulations for Code Numbers)

01 HAZARDOUS WASTE CODE	02 SUBSTANCE NAME	03 SOURCE OF WASTE (Activity Producing Waste)	04 TREATMENT METHOD (Ref. Process Codes)	05 STORAGE/DISPOSAL METHOD (Ref. Process Codes)	06 AMOUNT DISPOSED PER MONTH	07 UNIT OF MEASURE	08 CONCENTRATION AS DISPOSED	09 UNIT OF MEASURE
K071	Brine purification muds from the mercury cell process in chlorine production	Brine saturation and settling of impurities		D80	96	yd^3	5-100	ppm Hg
D009	Misc. Hg-contaminated wastes	Misc. operations associated with mercury-cell process in chlorine production		D80	17	yd^3	50-5000	ppm Hg

TOTAL QUANTITY OF HAZARDOUS WASTE DISPOSED PER MONTH = 113 yd^3

PROCESS CODES:

Treatment	Code	Treatment	Code	Storage:	Code	Disposal:	Code
TANK	T01	OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the process in the space provided. PART 2 III)	T04	CONTAINER (barrel, drum, etc)	S01	INJECTION WELL	D79
SURFACE IMPOUNDMENT	T02			TANK	S02	LANDFILL	D80
INCINERATOR	T03			WASTE PILE	S03	LAND APPLICATION	D81
				SURFACE IMPOUNDMENT	S04	OCEAN DISPOSAL	D82
				OTHER (Describe process in the space provided; Part 2 III)	S05	SURFACE IMPOUNDMENT	D83
						OTHER (Describe process in space provided, Part 2 III)	D84

17 8 0007

Tennessee Department of Public Health — Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 2—WASTE INFORMATION—Continued 17 8 0008

I. IDENTIFICATION

01 FACILITY ID NO. TND003337292

III. EXPLANATION OF PROCESS CODES, PARTICULARLY "OTHER" CODES USED IN PART 2-II.

N/A

PART 3—DESCRIPTIVE INFORMATION

I. FACILITY DESCRIPTION

01 DESCRIPTION OF METHOD OF OPERATION, CLOSURE, COVER, ETC.

Landfill operation; closed in place with topsoil and seeded

02 CURRENT USE AND SITE SECURITY (FENCING, LIGHTING, ETC.) WHERE APPLICABLE

No current use; secured by general plant security

II. CONTAINMENT

01 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, LEACHATE COLLECTION AND TREATMENT SYSTEMS, ETC.

N/A

III. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE (exposed at surface?): ☐ YES ☒ NO

02 COMMENTS

PART 4—DEMOGRAPHIC, WATER, AND ENVIRONMENTAL DATA

I. DEMOGRAPHIC AND PROPERTY INFORMATION

01 ESTIMATED TOTAL POPULATION:

A. Residents within ½ mi. radius 2 B. Residents within 1 mi. radius 16 C. No. Employees on site 818

02 PROVIDE USGS TOPOGRAPHIC MAP FOR 1 MI. RADIUS OF FACILITY SHOWING THE FOLLOWING: See attachment III

a. 20 ft. contours
b. existing roads, buildings and other major structures
c. drinking water intakes (both groundwater and surface water)

II. GROUNDWATER See attachment I

01 GROUNDWATER USE IN VICINITY (Check as applicable)

☐ A. ONLY SOURCE FOR DRINKING ☐ B. DRINKING (Other sources available) ☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available) ☐ D. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available) ☐ E. NOT USED, UNUSEABLE

02 POPULATION WITHIN 1 MI. RADIUS OF FACILITY WHICH IS SERVED BY GROUND WATER _____ (estimate)

03 DISTANCE TO NEAREST DOWN GRADIENT DRINKING WATER WELL _____ (mi. (estimate))

04 DEPTH TO UPPERMOST AQUIFER (ft.)	05 DIRECTION OF UPPERMOST AQUIFER FLOW	06 DEPTH TO AQUIFER OF CONCERN (ft.)	07 POTENTIAL YIELD OF AQUIFER (gpm)	08 SOLE SOURCE AQUIFER
				☐ YES ☐ NO

Tennessee Department of Public Health — Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 4—WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA 17 8 0009

I. IDENTIFICATION
01 FACILITY ID NO. TND003337292

GROUNDWATER—Continued

09 DESCRIPTION OF WELLS (including usage, depth, and location—latitude and longitude—within 1 mi. radius)

10 RECHARGE AREA
☐ YES
☐ NO
COMMENTS

11 DISCHARGE AREA
☒ YES
☐ NO
COMMENTS Based on discharge to [redacted].

III. SURFACE WATER

01 SURFACE WATER USE (Check one)
☒ A. RESERVOIR, RECREATION DRINKING WATER SOURCE ☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES ☐ C. COMMERCIAL, INDUSTRIAL ☐ D. NOT CURRENTLY USED

02 POTENTIALLY AFFECTED BODIES OF WATER

NAME	DISTANCE TO SITE
Hiwassee River	3/4 (mi)
	(mi)
	(mi)

IV. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one) No data
☐ A. 10^{-6} to 10^{-8} cm/sec ☐ B. 10^{-4} to 10^{-6} cm/sec ☐ C. 10^{-2} to 10^{-4} cm/sec ☐ D. GREATER THAN 10^{-2} cm/sec

02 PERMEABILITY OF BEDROCK (Check one) No data
☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec) ☐ B. RELATIVELY IMPERMEABLE (10^{-4} to 10^{-6} cm/sec) ☐ C. RELATIVELY PERMEABLE (10^{-2} to 10^{-4} cm/sec) ☐ D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
unknown (ft)	unknown (ft)	unknown

06 NET PRECIPITATION/YEAR	07 TEN YEAR 24 HOUR RAINFALL	08 SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
52 (in)	6 (in)	1-3 %	West	1-3 %

09 FLOOD POTENTIAL
FACILITY IS IN >500 YEAR FLOOD PLAIN

10 DISTANCE TO WETLANDS (5 acre minimum) unknown (mi)

11 DISTANCE TO CRITICAL HABITAT (of endangered species) _____ (mi)
ENDANGERED SPECIES unknown

12 DESCRIPTION OF FACILITY IN RELATION TO SURROUNDING TOPOGRAPHY

Facility follows natural terrain contours and features

V. PHOTOGRAPHS (Provide copies if readily available)

01 TYPE ☐ GROUND ☐ AERIAL
estimated
PHOTO DATE _____
PHOTO DATE _____

02 IN CUSTODY OF _____
(Name of organization and individual contact)
Address: _____
Phone No. _____

Tennessee Department of Public Health — Division of Solid Waste Management

Potential Hazardous Waste Disposal Facility

PART 5—SAMPLE AND FIELD INFORMATION	17 8 0010	I. IDENTIFICATION 01 FACILITY ID NO TND003337292

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 BRIEF SUMMARY OF ANALYTICAL RESULTS	03 SAMPLING DATES
GROUNDWATER	0		
SURFACE WATER	0		
AMBIENT AIR	0		
METHANE	0		
RUNOFF	0		
SOIL	0		
VEGETATION	0		
OTHER	0		

III. OTHER FIELD DATA COLLECTED (Provide field measurements and narrative description of other field data)

NONE

PART 6—OFF-SITE GENERATOR INFORMATION

I. OTHER GENERATORS WITHIN NOTIFIER'S COMPANY DISPOSING AT THIS FACILITY

01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
N/A		N/A	
03 STREET ADDRESS (P.O. Box, RFD #, etc.) / 04 SIC CODE		03 STREET ADDRESS (P.O. Box, RFD #, etc.) / 04 SIC CODE	
05 CITY / 06 STATE / 07 ZIP CODE		05 CITY / 06 STATE / 07 ZIP CODE	
01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
N/A		N/A	
03 STREET ADDRESS (P.O. Box, [redacted]) / 04 SIC CODE		03 STREET ADDRESS (P.O. Box, RFD #, etc.) / 04 SIC CODE	
05 CITY / 06 STATE / 07 ZIP CODE		05 CITY / 06 STATE / 07 ZIP CODE	

PART 7—SOURCES OF INFORMATION FOR THIS REPORT (Cite specific references, e.g., company files, sample analysis, reports)

Plant records
State Hazardous Waste Generator Notification
Personal interviews
Superfund Section 103(c) Notification

State of Tennessee — Department of Public Health
Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 1 - FACILITY INFORMATION AND ASSESSMENT 17 8 0011

I. IDENTIFICATION
01 DISPOSAL FACILITY D NO. TND003337292

II. FACILITY NAME AND LOCATION

01 FACILITY NAME (Legal, common, or descriptive name of site) Miscellaneous Sites (Fill area for modular warehouses 50 yd3 total.)
02 STREET, ROUTE NO. OR SPECIFIC LOCATION IDENTIFIER: Lower River Road
03 CITY: Charleston
04 STATE: TN
05 ZIP CODE: 37310
06 COUNTY: Bradley
07 COUNTY CODE:
08 COORDINATES LATITUDE: 35 18 50 N LONGITUDE: 084 47 20 W
09 DIRECTIONS TO FACILITY (Starting from nearest public road)
From Charleston plant entrance off Lower River Road, go 3/4 mile to north maintenance warehouse; turn left, cross railroad tracks. Facility is south of road.

III. RESPONSIBLE PARTIES

01 OWNER (If known): Olin Corporation
02 STREET: 120 Long Ridge Road
03 CITY: Stamford
04 STATE: CT
05 ZIP CODE: 06904
06 TELEPHONE NUMBER: (203) 356-2000
07 OPERATOR (If known and different from owner): ----
08 STREET: ---
09 CITY: ----
10 STATE: --
11 ZIP CODE: -----
12 TELEPHONE NUMBER: (---)-----
13 TYPE OF OWNERSHIP (Check one)
☒ A. PRIVATE ☐ B. FEDERAL: _____ (Agency name) ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL
☐ F. OTHER: _____ (Specify) ☐ G. UNKNOWN

14. FACILITY STATUS (Check one)
☐ A. ACTIVE ☒ B. INACTIVE ☐ C. UNKNOWN
15 YEARS OF OPERATION: 1968 (BEGINNING YEAR) | 1969 (ENDING YEAR) ☐ UNKNOWN

IV. NOTIFIER INFORMATION

01 NOTIFIER NAME (Company name): Olin Corporation
02 STREET OR BOX NO.: P.O. Box 248
03 TELEPHONE NUMBER: (615) 336-2251
04 CITY: Charleston
05 STATE: TN
06 ZIP CODE: 37310
07 COUNTY: Bradley
08 DATE: 5 / 20 / 82 (MONTH DAY YEAR)
09 CONTACT NAME: J.P. Newman
10 CONTACT TITLE: Manager, Product Quality and Environmental Control
11 SIC CODE AND DESCRIPTION LISTED
2812 Alkalies and Chlorine; 2819 Industrial Inorganic Chemicals
12 BRIEF DESCRIPTION OF PRODUCTION PROCESS (ITEMS PRODUCED, ACTIVITIES INCLUDED, ETC.)
1. Manufacture chlorine and sodium hydroxide (caustic soda) using the mercury electrolytic cell process.
2. Manufacture sodium hydrosulfite (Reductone®) using the mercury, electrolytic cell process and chemical reaction process.
3. Manufacture calcium hypochlorite (HTH®) using a chemical reaction process.
4. Manufacture dry caustic soda by evaporation.

PART 2. INFORMATION CONCERNING WASTES DISPOSED AT REFERENCED FACILITY

I. WASTE STATES, QUANTITIES, AND CHARACTERISTICS AT TIME OF DISPOSAL

01 PHYSICAL STATES (Check all that apply)
☒ A. SOLID ☐ E. SLURRY
☐ B. POWDER, FINES ☐ F. LIQUID
☐ C. SLUDGE ☐ G. GAS
☐ D. OTHER semi-solid (Specify)

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)
TONS _____
OR CUBIC YARDS 50
OR NO. OF DRUMS _____

03 WASTE CHARACTERISTICS (Check all that apply)
☐ Ignitable ☐ Toxic
☐ Reactive ☒ EP Toxic
☐ Corrosive ☐ Other _____

04 DATES OF WASTE DISPOSAL BY NOTIFER AT ABOVE SITE: FROM 1962 TO 1982

Report on Potential Hazardous Waste Disposal Facility

PART 2 · WASTE INFORMATION—continued

I. IDENTIFICATION

01 DISPOSAL FACILITY ID NO: TND003337292

II. HAZARDOUS WASTES (Reference Hazardous Waste Regulations for Code Numbers)

01 HAZARDOUS WASTE CODE	02 SUBSTANCE NAME	03 SOURCE OF WASTE (Activity Producing Waste)	04 TREATMENT METHOD (Ref. Process Codes)	05 STORAGE/DISPOSAL METHOD (Ref. Process Codes)	06 AMOUNT DISPOSED PER MONTH	07 UNIT OF MEASURE	08 CONCENTRATION AS DISPOSED	09 UNIT OF MEASURE
D009	Misc. Hg-contaminated wastes	Misc. operations associated with mercury-cell process in chlorine production		D81	4.1	yd^3	0-50	ppm Hg

TOTAL QUANTITY OF HAZARDOUS WASTE DISPOSED PER MONTH = $4.1\ yd^3$

PROCESS CODES:

Treatment	Code	Treatment	Code	Storage:	Code	Disposal:	Code
TANK	T01	OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the process in the space provided: PART 2 III)	T04	CONTAINER (barrel, drum, etc)	S01	INJECTION WELL	D79
SURFACE IMPOUNDMENT	T02			TANK	S02	LANDFILL	D80
INCINERATOR	T03			WASTE PILE	S03	LAND APPLICATION	D81
				SURFACE IMPOUNDMENT	S04	OCEAN DISPOSAL	D82
				OTHER (Describe process in the space provided; Part 2 III)	S05	SURFACE IMPOUNDMENT	D83
						OTHER (Describe process in space provided; Part 2 III)	D84

178 0012

Tennessee Department of Public Health — Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 2—WASTE INFORMATION—Continued 17 8 0013

I. IDENTIFICATION

01 FACILITY ID NO. TND003337292

III. EXPLANATION OF PROCESS CODES, PARTICULARLY "OTHER" CODES USED IN PART 2-II.

N/A

PART 3—DESCRIPTIVE INFORMATION

I. FACILITY DESCRIPTION

01 DESCRIPTION OF METHOD OF OPERATION, CLOSURE, COVER, ETC.

Land application; wastes used as fill, covered with topsoil, and seeded.

02 CURRENT USE AND SITE SECURITY (FENCING, LIGHTING, ETC.) WHERE APPLICABLE

Facility currently used as foundation for light-duty building with concrete slab; light traffic.

II. CONTAINMENT

01 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, LEACHATE COLLECTION AND TREATMENT SYSTEMS, ETC.

N/A

III. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE (disposed at surface)? ☐ YES ☒ NO

02 COMMENTS

PART 4—DEMOGRAPHIC, WATER, AND ENVIRONMENTAL DATA

I. DEMOGRAPHIC AND PROPERTY INFORMATION

01 ESTIMATED TOTAL POPULATION

A. Residents within ½ mi. radius 0 B. Residents within 1 mi. radius 4 C. No. Employees on site 818

02 PROVIDE USGS TOPOGRAPHIC MAP FOR 1 MI. RADIUS OF FACILITY SHOWING THE FOLLOWING:

a. 20 ft. contours
b. existing roads, buildings and other major structures
c. drinking water intakes (both groundwater and surface water)

See attachment III

II. GROUNDWATER See attachment I

01 GROUNDWATER USE IN VICINITY (Check as appropriate)

☐ A. ONLY SOURCE FOR DRINKING ☐ B. DRINKING (Other sources available) ☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available) ☐ D. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available) ☐ E. NOT USED, UNUSEABLE

02 POPULATION WITHIN 1 MI. RADIUS OF FACILITY WHICH IS SERVED BY GROUND WATER _____ (estimate)

03 DISTANCE TO NEAREST DOWN GRADIENT DRINKING WATER WELL _____ (mi) (estimate)

04 DEPTH TO UPPERMOST AQUIFER	05 DIRECTION OF UPPERMOST AQUIFER FLOW	06 DEPTH TO AQUIFER OF CONCERN	07 POTENTIAL YIELD OF AQUIFER	08 SOLE SOURCE AQUIFER
(ft)		(ft)	(gpd)	☐ YES ☐ NO

Tennessee Department of Public Health — Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 4—WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA 17 8 0014

I. IDENTIFICATION
01 FACILITY ID NO. TND003337292

II. GROUNDWATER—Continued

08 DESCRIPTION OF WELLS (including usage, depth, and location—latitude and longitude—within 1 mi. radius)

10 RECHARGE AREA
☐ YES ☐ NO COMMENTS

11 DISCHARGE AREA
☒ YES ☐ NO COMMENTS Based on discharge to river.

III. SURFACE WATER

01 SURFACE WATER USE (Check one)
☒ A. RESERVOIR, RECREATION DRINKING WATER SOURCE ☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES ☐ C. COMMERCIAL, INDUSTRIAL ☒ D. NOT CURRENTLY USED

02 POTENTIALLY AFFECTED BODIES OF WATER

NAME	DISTANCE TO SITE
Hiwassee River	3/8 (mi)
	(mi)
	(mi)

IV. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one) No data
☐ A. 10^{-6} to 10^{-4} cm/sec ☐ B. 10^{-4} to 10^{-2} cm/sec ☐ C. 10^{-2} to 10^{-1} cm/sec ☐ D. GREATER THAN 10^{-1} cm/sec

02 PERMEABILITY OF BEDROCK (Check one) No data
☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec) ☐ B. RELATIVELY IMPERMEABLE (10^{-6} to 10^{-2} cm/sec) ☐ C. RELATIVELY PERMEABLE (10^{-2} to 10^{-1} cm/sec) ☐ D. VERY PERMEABLE (Greater than 10^{-1} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
unknown (ft)	unknown (ft)	unknown

06 NET PRECIPITATION/YEAR	07 TEN YEAR 24 HOUR RAINFALL	08 SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
52 (in)	6 (in)	0-1 %	North	0-1 %

09 FLOOD POTENTIAL
FACILITY IS IN 100 YEAR FLOOD PLAIN

10 DISTANCE TO WETLANDS (5 acre minimum) unknown (mi)

11 DISTANCE TO CRITICAL HABITAT (of endangered species) _____ (mi)
ENDANGERED SPECIES unknown

12 DESCRIPTION OF FACILITY IN RELATION TO SURROUNDING TOPOGRAPHY

Elevated approximately 5' above nearby field, but matches elevation of plant proper.

V. PHOTOGRAPHS (Provide copies if readily available)

01 TYPE ☐ GROUND ☐ AERIAL
(estimated)
PHOTO DATE _____
PHOTO DATE _____

02 IN CUSTODY OF _____
(Name of organization and individual contact)
Address: _____
Phone No.: _____

Tennessee Department of Public Health — Division of Solid Waste Management

Potential Hazardous Waste Disposal Facility

PART 5—SAMPLE AND FIELD INFORMATION	17 8 0015	I. IDENTIFICATION 01 FACILITY ID NO. TND003337292

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 BRIEF SUMMARY OF ANALYTICAL RESULTS	03 SAMPLING DATES
GROUNDWATER	0		
SURFACE WATER	0		
AMBIENT AIR	0		
METHANE	0		
RUNOFF	0		
SOIL	0		
VEGETATION	0		
OTHER	0		

III. OTHER FIELD DATA COLLECTED (Provide field measurements and narrative description of other field data)

NONE

PART 6—OFF-SITE GENERATOR INFORMATION

I. OTHER GENERATORS WITHIN NOTIFIER'S COMPANY DISPOSING AT THIS FACILITY

01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
N/A		N/A	
03 STREET ADDRESS (P.O. Box, RFD #, etc.) / 04 SIC CODE		03 STREET ADDRESS (P.O. Box, RFD #, etc.) / 04 SIC CODE	
05 CITY / 06 STATE / 07 ZIP CODE		05 CITY / 06 STATE / 07 ZIP CODE	
01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
N/A		N/A	
03 STREET ADDRESS (P.O. Box, [redacted]) / 04 SIC CODE		03 STREET ADDRESS (P.O. Box, RFD #, etc.) / 04 SIC CODE	
05 CITY / 06 STATE / 07 ZIP CODE		05 CITY / 06 STATE / 07 ZIP CODE	

PART 7—SOURCES OF INFORMATION FOR THIS REPORT (Cite specific references, e.g., company files, sampling analysis, reports)

Plant records
State Hazardous Waste Generator Notification
Personal interviews
Superfund Section 103(c) Notification

State of Tennessee — Department of Public Health
Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 1 - FACILITY INFORMATION AND ASSESSMENT 17 8 0016

I. IDENTIFICATION
01 DISPOSAL FACILITY ID NO: TND003337292

II. FACILITY NAME AND LOCATION

01 FACILITY NAME (Legal, common, or descriptive name of site): West Disposal Area	02 STREET, ROUTE NO. OR SPECIFIC LOCATION IDENTIFIER: Lower River Road

03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE
Charleston	TN	37310	Bradley	

08 COORDINATES — LATITUDE: 35 18 50 N | LONGITUDE: 084 47 20 W

09 DIRECTIONS TO FACILITY (Starting from nearest public road)
From Charleston plant main entrance off Lower River Road, go 3/4 mile to North maintenance warehouse, turn left, travel 1/4 mile west to West Disposal Area just north of road.

III. RESPONSIBLE PARTIES

01 OWNER (If known): Olin Corporation	02 STREET: 120 Long Ridge Road

03 CITY	04 STATE	05 ZIP CODE	06 TELEPHONE NUMBER
Stamford	CT	06904	(203) 356-2000

07 OPERATOR (If known and different from owner): -----	08 STREET: -----

09 CITY	10 STATE	11 ZIP CODE	12 TELEPHONE NUMBER
-----	--	-----	(---) -------

13 TYPE OF OWNERSHIP (Check one)
☒ A. PRIVATE ☐ B. FEDERAL: _____ (Agency name) ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL
☐ F. OTHER: _____ (Specify) ☐ G. UNKNOWN

14 FACILITY STATUS (Check one)
☐ A. ACTIVE ☒ B. INACTIVE ☐ C. UNKNOWN

15 YEARS OF OPERATION: 1968 (BEGINNING YEAR) | 1980 (ENDING YEAR) ☐ UNKNOWN

IV. NOTIFIER INFORMATION

01 NOTIFIER NAME (Company name)	02 STREET OR BOX NO.	03 TELEPHONE NUMBER
Olin Corporation	P.O. Box 248	(615) 336-2251

04 CITY	05 STATE	06 ZIP CODE	07 COUNTY	08 DATE
Charleston	TN	37310	Bradley	5 / 20 / 82 (MONTH DAY YEAR)

09 CONTACT NAME	10 CONTACT TITLE
J.P. Newman	Manager, Product Quality and Environmental Control

11 SIC CODE AND DESCRIPTION LISTED
2812 Alkalies and Chlorine; 2819 Industrial Inorganic Chemicls

12 BRIEF DESCRIPTION OF PRODUCTION PROCESS (ITEMS PRODUCED, ACTIVITIES INCLUDED, ETC.)
1. Manufacture chlorine and sodium hydroxide (caustic soda) using the mercury electrolytic cell process.
2. Manufacture sodium hydrosulfite (Reductone®) using the mercury, electrolytic cell process and chemical reaction process.
3. Manufacture calcium hypochlorite (HTH®) using a chemical reaction process.
4. Manufacture dry caustic soda by evaporation.

PART 2. INFORMATION CONCERNING WASTES DISPOSED AT REFERENCED FACILITY

I. WASTE STATES, QUANTITIES, AND CHARACTERISTICS AT TIME OF DISPOSAL

01 PHYSICAL STATES (Check all that apply)
☒ A. SOLID ☐ E. SLURRY
☐ B. POWDER, FINES ☐ F. LIQUID
☐ C. SLUDGE ☐ G. GAS
☒ D. OTHER: Semi-solid (Specify)

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)
TONS: _____
OR CUBIC YARDS: 23,000
OR NO. OF DRUMS: _____

03 WASTE CHARACTERISTICS (Check all that apply)
☐ Ignitable ☐ Toxic
☐ Reactive ☒ EP Toxic
☐ Corrosive ☒ Other: K071;K106

04. DATES OF WASTE DISPOSAL BY NOTIFER AT ABOVE SITE: FROM 1962 TO 1982

Tennessee Department of Public Health — Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 2 - WASTE INFORMATION—continued

I. IDENTIFICATION

01 DISPOSAL FACILITY ID NO: TND003337292

II. HAZARDOUS WASTES (Reference Hazardous Waste Regulations for Code Numbers)

01 HAZARDOUS WASTE CODE	02 SUBSTANCE NAME	03 SOURCE OF WASTE (Activity Producing Waste)	04 TREATMENT METHOD (Ref. Process Codes)	05 STORAGE/DISPOSAL METHOD (Ref. Process Codes)	06 AMOUNT DISPOSED PER MONTH	07 UNIT OF MEASURE	08 CONCENTRATION AS DISPOSED	09 UNIT OF MEASURE
K071	Brine purification muds from the mercury cell process in chlorine production	Brine saturation and settling of impurities		D80	121	yd^3	5-100	ppm Hg
K106 *	Wastewater treatment sludge from the mercury cell process in chlorine production	Precipitation and filtration of HgS from wastewater		D80	3	yd^3	2000-10000	ppm Hg
D009	Misc. Hg-contaminated wastes	Misc. operations associated with mercury-cell process in chlorine production		D80	23	yd^3	50-5000	ppm Hg

* Essentially all of the Hg is tied up as HgS, a salt with low leachability. The process which produces this waste represents BAT.

TOTAL QUANTITY OF HAZARDOUS WASTE DISPOSED PER MONTH = 147 yd^3

PROCESS CODES:

Treatment	Code	Treatment	Code	Storage:	Code	Disposal:	Code
TANK	T01	OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the process in the space provided. PART 2 III)	T04	CONTAINER (barrel, drum, etc)	S01	INJECTION WELL	D79
SURFACE IMPOUNDMENT	T02			TANK	S02	LANDFILL	D80
INCINERATOR	T03			WASTE PILE	S03	LAND APPLICATION	D81
				SURFACE IMPOUNDMENT	S04	OCEAN DISPOSAL	D82
				OTHER (Describe process in the space provided, Part 2 III)	S05	SURFACE IMPOUNDMENT	D83
						OTHER (Describe process in space provided, Part 2 III)	D84

17 8 0017

Tennessee Department of Public Health — Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

PART 2—WASTE INFORMATION—Continued 17 8 0018

I. IDENTIFICATION
01 FACILITY ID NO
TND003337292

I. EXPLANATION OF PROCESS CODES, PARTICULARLY "OTHER" CODES USED IN PART 2-II.

N/A

PART 3—DESCRIPTIVE INFORMATION

I. FACILITY DESCRIPTION

01 DESCRIPTION OF METHOD OF OPERATION, CLOSURE, COVER, ETC.
Landfill operation; facility closed in place with 2' compacted clay ($10^{-4} \rightarrow 10^{-5}$ cm/sec), 1' native soil, and 6" topsoil. Cap was graded to provide good drainage, and seeded. The facility is monitored by an ongoing groundwater monitoring program.

03 CURRENT USE AND SITE SECURITY (FENCING, LIGHTING, ETC.) WHERE APPLICABLE
No current use; area is fenced on three sides, with natural river barrier on north side. Secured by general plant security.

II. CONTAINMENT

01 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, LEACHATE COLLECTION AND TREATMENT SYSTEMS, ETC.
Cover provided by a two (2) foot compacted clay cap with permeabilities ranging from 1×10^{-4} to 1×10^{-5} cm/sec, with additional eighteen (18) inches of native soil and topsoil, seeded with grass and sloped at 1% to provide natural drainage.

III. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE (exposed at surface)? ☐ YES ☒ NO

02 COMMENTS

PART 4—DEMOGRAPHIC, WATER, AND ENVIRONMENTAL DATA

I. DEMOGRAPHIC AND PROPERTY INFORMATION

01 ESTIMATED TOTAL POPULATION
A. Residents within ½ mi. radius 0 B. Residents within 1 mi. radius 4 C. No. Employees on site 818

02 PROVIDE USGS TOPOGRAPHIC MAP FOR 1 MI. RADIUS OF FACILITY SHOWING THE FOLLOWING: See attachment III
a. 20 ft. contours
b. existing roads, buildings and other major structures
c. drinking water intakes (both groundwater and surface water)

II. GROUNDWATER See attachment II

01 GROUNDWATER USE IN VICINITY (Check as applicable)
☐ A. ONLY SOURCE FOR DRINKING ☐ B. DRINKING (Other sources available) ☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available) ☐ D. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available) ☐ E. NOT USED, UNUSEABLE

02 POPULATION WITHIN 1 MI. RADIUS OF FACILITY WHICH IS SERVED BY GROUND WATER _____ (estimate)

03 DISTANCE TO NEAREST DOWN GRADIENT DRINKING WATER WELL _____ (mi) (estimate)

04 DEPTH TO UPPERMOST AQUIFER (ft)	05 DIRECTION OF UPPERMOST AQUIFER FLOW	06 DEPTH TO AQUIFER OF CONCERN (ft)	07 POTENTIAL YIELD OF AQUIFER (gpm)	08 SOLE SOURCE AQUIFER
				☐ YES ☐ NO

17 8 0019

Tennessee Department of Public Health — Division of Solid Waste Management

Report on Potential Hazardous Waste Disposal Facility

—WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 FACILITY ID NO. TND003337292

II. GROUNDWATER—Continued

09 DESCRIPTION OF WELLS (Including usage, depth, and location—latitude and longitude—within 1 mi. radius)

10 RECHARGE AREA
☐ YES
☐ NO
COMMENTS

11 DISCHARGE AREA
☒ YES
☐ NO
COMMENTS Based on discharge to river

III. SURFACE WATER

01 SURFACE WATER USE (Check one)
☒ A. RESERVOIR, RECREATION DRINKING WATER SOURCE ☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES ☐ C. COMMERCIAL, INDUSTRIAL ☐ D. NOT CURRENTLY USED

02 POTENTIALLY AFFECTED BODIES OF WATER

NAME	DISTANCE TO SITE
Hiwassee River	1/4 (mi)
	(mi)
	(mi)

IV. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)
☐ A. 10^{-6} to 10^{-4} cm/sec ☒ B. 10^{-4} to 10^{-2} cm/sec ☐ C. 10^{-2} to 10^{-1} cm/sec ☐ D. GREATER THAN 10^{-1} cm/sec

ABILITY OF BEDROCK (Check one) No data
☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec) ☐ B. RELATIVELY IMPERMEABLE (10^{-4} to 10^{-6} cm/sec) ☐ C. RELATIVELY PERMEABLE (10^{-2} to 10^{-4} cm/sec) ☐ D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
30 (ft)	Unknown, (ft) but see depth to bedrock	No data

06 MET PRECIPITATION/YEAR	07 TEN YEAR 24 HOUR RAINFALL	08 SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
52 (in)	6 (in)	0-1 %	North	0-1 %

09 FLOOD POTENTIAL
FACILITY IS IN 100 YEAR FLOOD PLAIN

10 DISTANCE TO WETLANDS (5 acre minimum) unknown (mi)

11 DISTANCE TO CRITICAL HABITAT (of endangered species) _____ (mi)
ENDANGERED SPECIES: unknown

12 DESCRIPTION OF FACILITY IN RELATION TO SURROUNDING TOPOGRAPHY

Facility follows natural terrain contours and features, since it was artificially contoured to provide good drainage.

V. PHOTOGRAPHS (Provide copies if readily available)

☐ GROUND ☒ AERIAL

(Dates estimated)
EARLIEST PHOTO DATE _____
LATEST PHOTO DATE _____

02 IN CUSTODY OF _____
(Name of organization and individual contact)
Address. _____
Phone No. _____

Tennessee Department of Public Health — Division of Solid Waste Management

Potential Hazardous Waste Disposal Facility

PART 5—SAMPLE AND FIELD INFORMATION 17 8 0020

I. IDENTIFICATION
01 FACILITY ID NO. TND003337292

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 BRIEF SUMMARY OF ANALYTICAL RESULTS	03 SAMPLING DATES
GROUNDWATER	97	(See attached Tables 1 and 2)	3/79-5/82
SURFACE WATER	0		
AMBIENT AIR	0		
METHANE	0		
RUNOFF	0		
SOIL	0		
VEGETATION	0		
OTHER	0		

III. OTHER FIELD DATA COLLECTED (Provide field measurements and narrative description of other field data)

This facility is monitored by an on-going monitoring program of eight (8) monitoring wells measured for groundwater table, mercury, total chlorides, and pH. Preliminary data (post-capping) indicate a reduction in groundwater contamination.

PART 6—OFF-SITE GENERATOR INFORMATION

I. OTHER GENERATORS WITHIN NOTIFIER'S COMPANY DISPOSING AT THIS FACILITY

01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
N/A		N/A	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE
01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
N/A		N/A	
03 STREET ADDRESS (P.O. Box, [illegible])	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE

PART 7—SOURCES OF INFORMATION FOR THIS REPORT (Cite specific references, e.g., company files, sample analysis, reports)

Plant records
State Hazardous Waste Generator Notification
Personal interviews
Superfund Section 103(c) Notification
Internal engineering design specifications
Contractor well-drilling reports