

SHIP PRODUCTION COMMITTEE
FACILITIES AND ENVIRONMENTAL EFFECTS
SURFACE PREPARATION AND COATINGS
DESIGN/PRODUCTION INTEGRATION
HUMAN RESOURCE INNOVATION
MARINE INDUSTRY STANDARDS
WELDING
INDUSTRIAL ENGINEERING
EDUCATION AND TRAINING

August 1990
NSRP 0320

THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

1990 Ship Production Symposium

Paper No. 4B-1: Solving SARA Compliance with Computerized Hazardous Materials Tracking

U.S. DEPARTMENT OF THE NAVY
CARDEROCK DIVISION,
NAVAL SURFACE WARFARE CENTER

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE AUG 1990		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE The National Shipbuilding Research Program, 1990 Ship Production Symposium, Paper No. 4B-1: Solving SARA Compliance With Computerized Hazardous Materials Tracking				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Surface Warfare Center CD Code 2230-Design Integration Tools Bldg 192, Room 128 9500 MacArthur Blvd, Bethesda, MD 20817-5700				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 12	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

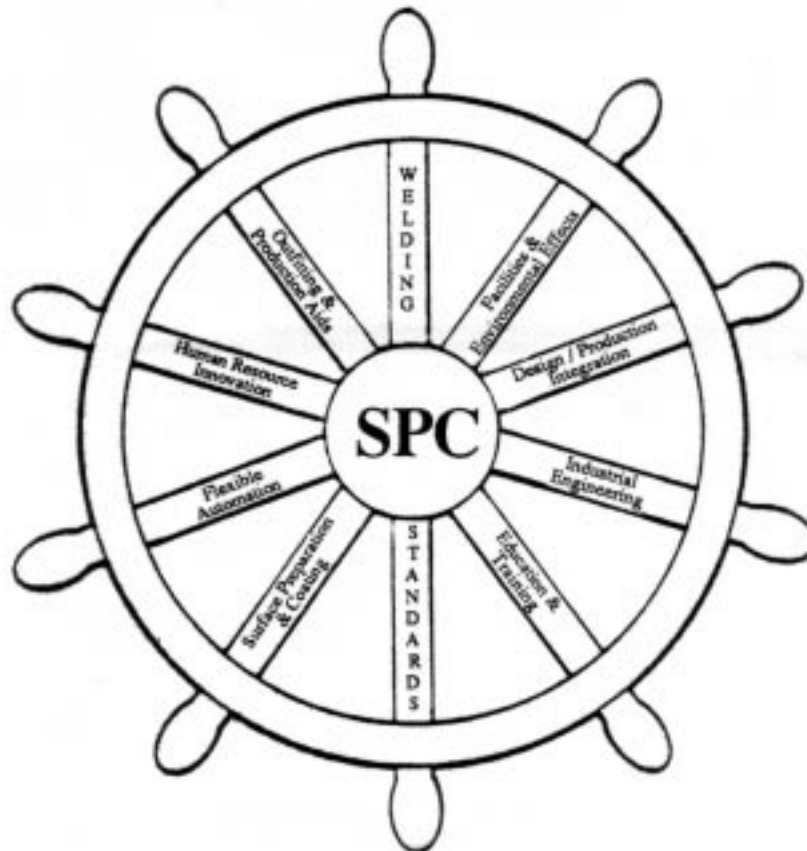
DISCLAIMER

These reports were prepared as an account of government-sponsored work. Neither the United States, nor the United States Navy, nor any person acting on behalf of the United States Navy (A) makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness or usefulness of the information contained in this report/manual, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or (B) assumes any liabilities with respect to the use of or for damages resulting from the use of any information, apparatus, method, or process disclosed in the report. As used in the above, "Persons acting on behalf of the United States Navy" includes any employee, contractor, or subcontractor to the contractor of the United States Navy to the extent that such employee, contractor, or subcontractor to the contractor prepares, handles, or distributes, or provides access to any information pursuant to his employment or contract or subcontract to the contractor with the United States Navy. ANY POSSIBLE IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR PURPOSE ARE SPECIFICALLY DISCLAIMED.

THE NATIONAL SHIPBUILDING RESEARCH PROGRAM'S

1990 SHIP PRODUCTION SYMPOSIUM

Preparing for the 21st Century:
Focusing on Productivity and Quality Management



August 22-24, 1990
Pfister Hotel
Milwaukee, Wisconsin

SPONSORED BY THE SHIP PRODUCTION COMMITTEE
AND HOSTED BY THE GREAT LAKES AND RIVERS SECTION OF
THE SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS





THE SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS
601 Pavonia Avenue, Jersey City, NJ 07306

Paper presented at the NSRP 1990 Ship Production Symposium,
Pfister Hotel, Milwaukee, Wisconsin, August 21-24, 1990

Solving SARA Compliance with Computerized Hazardous Materials Tracking

4B-1

Don Johnston, Dave Schoenleber, Peterson Builders, Inc., Sturgeon Bay, WI

ABSTRACT

The advent of the Superfund Amendment and Reauthorization Act (SARA) Title III, or the Emergency Planning and Citizen Right-to-Know Act (EPCRA) has forced facilities to keep track of hazardous materials as never before. EPCRA contains five major reporting requirements including planning notification, emergency release notification, Material Safety Data Sheet (MSDS) submission, chemical inventory reporting and toxic chemical release reporting. The complexity and vastness of the above requirements all but requires a computerized system for hazardous material management.

Peterson Builders, Inc. developed a computerized hazardous materials management system capable of meeting the requirements of EPCRA. After one year of operation, the system has proven successful. This paper discusses Peterson Builders experience in implementing the system, system design, and future considerations for the system.

NOMENCLATURE

DBMS- Data Base Management System.

EHS. Extremely Hazardous Substance.

EPCRA.- The Emergency Planning and Community Right-To-Know Act, or SARA Title III.

LAN. Local Area Network.

LEPC- Local Emergency Response Committee.

MSDS. Material Safety Data Sheet.

OSHA. The Occupational Safety and Health Act, or The Occupational Health and Safety Agency.
pc. Personal Computer. P.O. Purchase order.

RQ. Reportable Quantity.

SARA. The Superfund Amendment and Reauthorization Act.

-SERC- State Emergency Response Commission.

TPQ. Threshold Planning Quantity.

INTRODUCTION

SARA Title III.

In October of 1986, Congress passed the Superfund Amendments and Reauthorization Act, otherwise known as SARA. Like its predecessor, the Comprehensive Environmental Restoration and Contamination Liability Act (CERCLA), SARA dealt with the restoration of sites contaminated by toxic and hazardous wastes. Unlike its predecessor, SARA contained a stand alone act under Title III, otherwise known as the Emergency Planning and Community Right-To-Know Act, or EPCRA.

EPCRA was developed in response to chemical catastrophes such as the Methyl Isocyanate release in Bhopal, India. Thousands of people were killed or left with permanent disabilities. Several toxic chemical releases in the United States occurred after Bhopal, including a Methyl Isocyanate release in Institute, West Virginia shattering the "it could not happen in the U.S." myth. No deaths occurred in Institute, but six workers and twenty five community members

were hospitalized. Congress, driven by a sensitized and outraged public, took action.

Any facility that possesses certain chemicals over Threshold Planning Quantities is subject to regulation under EPCRA. The chemicals covered by EPCRA are divided into three categories; Extremely Hazardous Substances, Toxic Chemicals, and CERCLA Hazardous Substances and Occupational Safety and Health Act (OSHA) Hazardous Chemicals. There are discrete lists for Extremely Hazardous Substances and for Toxic Chemicals. The third category, a combination of chemicals regulated under CERCLA and OSHA does not have a discrete, finite list. OSHA regulations are performance based, setting criteria under which a chemical is regulated. An estimate of the number of chemicals regulated by OSHA is over 50,000 .

There are five key sections of EPCRA that contain reporting and notification requirements with which facilities must comply .

1. Section 302 of EPCRA deals with Emergency Planning Notification and is based on the Extremely Hazardous Substances (EHS) list. All facilities that produce, use, or store an EHS above the Threshold Planning Quantity (TPQ) for that chemical must notify the State Emergency Response Commission (SERC) that EHS's are located at the facility.
2. Section 304 requires facilities that produce, use, or store OSHA Hazardous Chemicals to report accidental releases of Extremely Hazardous Substances above a Reportable Quantity (RQ) to the Local Emergency Planning Committee (LEPC), the SERC and to the EPA Regional Administrator.
3. Section 311 requires facilities subject to the OSHA Hazard Communication Standard (HCS or "Hazcom") to submit

Material Safety Data Sheets (MSDS) to the local Fire Department, the LEPC and the SERC. A list of chemicals at the facility along with their hazardous properties can be submitted instead of MSDS's. New or updated Material Safety Data Sheets must be submitted with 90 days.

4. Section 312 requires that a facility annually report all Extremely Hazardous Substances, CERCLA Hazardous Substances, and OSHA Hazardous Chemicals present at the facility in quantities exceeding the reporting threshold. At present, the threshold for OSHA Hazardous Chemicals is 10,000 pounds. Extremely Hazardous Substances have a threshold of 500 pounds or an individual RQ, whichever is lower.
5. Section 313 requires that a facility report emissions of Toxic Chemicals processed, manufactured or otherwise used above a set threshold. The threshold differs depending on how a facility handles a chemical: 25,000 pounds for chemicals manufactured or processed, and 10,000 pounds for chemicals that are otherwise used. This requirement applies only to facilities in the Standard Industrial Classification codes 20 to 39 and that employ 10 or more employees.

Developing the Hazardous Materials Tracking System

The complexity and amount of data involved with EPCRA compliance dictated the need for a computerized data base management system. The shipyard has over 1500 MSDS's, most containing multiple chemical components. Each of these chemicals must be evaluated to determine if they must be included in a SARA 312 or 313 report come reporting time. Shipbuilding also dictates the need for tracking hazardous materials. The Local Emergency Planning

Committee (LEPC) requires that the location of hazardous materials be known for emergency planning purposes. Since ships can not be easily moved, hazardous materials must be moved to construction sites. As the building of a ship at a given location progresses, the types and amounts of hazardous materials at the location changes. To handle the ever changing conditions, it was decided to track the containers holding the materials regulated under EPCRA.

The first decision that was confronted was that of creating our own tracking system or purchasing a software package with tracking capabilities. After an extensive review of the packages available at the time, the decision was made to build our own system. Only a few software packages offered tracking capability. Available packages provided chemical tracking. Most hazardous materials used are mixtures of chemicals however. To complete a transaction in the available software packages, an entry would have to be made for each chemical in the mixture. This would have become very tedious for hazardous materials composed of many chemicals. A tracking system that was based on container transactions (receipt, movement and consumption) was needed.

The shipyard had approximately 40 Personal Computers (PCs) linked together in a Local Area Network (LAN). The decision was made to utilize the existing Database Management System (DBMS) on the LAN for the tracking system. Most manufacturing units that handle hazardous materials had access to a PC linked to the LAN. Most manufacturing departments also had personnel trained to use the DBMS on the LAN. The system was conceived with the requirement that each manufacturing department be responsible for data entry for its hazardous material transactions. It was hoped that requiring each department handling hazardous materials to perform their own data entry would distribute the workload, help develop

awareness of Hazardous Material usage and keep data accuracy high. Additional PCs were purchased and personnel trained for those departments lacking these commodities.

DATABASE STRUCTURE

Normalization.

The design of the database began with the decision to follow the Third Order Normalized structure³. Normalization is a process of grouping data together in a form that is more amendable to change and that minimizes the impact of change to the system. The need to develop a system that can handle change was considered vital since environmental regulations change constantly. System development began in October of 1988, with a desired on-line date of January 2, 1989. This allowed only two months for system development, so the design of the system was made to allow for easy modification. Third Order Normalized structure allowed for easier and less disruptive fixes later on.

Grouping of Data.

The Hazardous Materials Tracking System is comprised of three major data groups.

1. Container Information:
Includes container type and size, contents, location, amount used (removed from container) and dates of receipt, movement, and use. All data relating to the use of hazardous materials is kept on a container basis.
2. MSDS Information:
Includes chemical components (with Chemical Abstract System (CAS) number, lower and upper percentage of composition), product name(s), manufacturer (name, address, and phone number(s)), and physical, health, safety and emergency response data.

3. Regulatory Information:
Includes Threshold Planning Quantities (TPQ) and Reportable Quantities (RQ).

A seven digit product code is assigned to each different hazardous material. Different product codes are assigned to the same hazardous material obtained from different manufacturers. Product codes are assigned sequentially, without any attempt to assign significance to any individual digit or groups of digits. The only exception to this rule is that the first digit is assigned as 7. The product codes were designed to match the format of a number assigned materials by the Material Control Department to those materials purchased under contract. Many noncontract materials were found to be hazardous materials. It was hoped that the product codes assigned by the Environmental Affairs Department could be used by the Material control Department.

A seven digit number is also assigned to each container tracked on the system. Rolls of one inch by two inch labels are purchased with preprinted numbers running in consecutive order. The first two digits of the number represent the year that the labels were purchased. A new sequence of numbers is started with the first label purchase of a new calendar year to avoid ever increasing container numbers.

Information about containers is stored in two separate files. One file, called CONTAINER stores information about the present state of containers. This file can be queried to determine the number of containers present for a certain product and where those containers are located. The CONTAINER HISTORY file stores information about container transactions. Some of the possible transactions that are recorded are: receipt (arrival of material at the shipyard); movement (physical change in location); transfer (between departments); and consumption. The date and time of each transaction is

recorded.

MSDS data is stored in three files; PRODUCT, COMPONENT, and SYNONYM. The PRODUCT file contains the majority of the data pertaining to each hazardous material, including the hazardous material's name, manufacturer, physical attributes, and health and safety data. All data in the PRODUCT file was standardized as much as possible - the possible responses for each field were restricted to a few choices or the choices were predetermined. Standardizing MSDS data requires personnel with a good working knowledge of MSDS information. Entry time is greater than for copying information verbatim but data storage space is saved. The standardized data is not meant to take the place of MSDS information, but to provide data for report calculations and quick reference data in an emergency.

The COMPONENT file contains the chemical information from MSDS's: CAS number (or a component number when CAS number is missing); and the minimum and maximum percentage of the chemical in the hazardous material. When the percentage of a chemical is not given, zero (0) percent is assumed for the minimum and 100 percent is assumed for the maximum. Chemical names are stored in the SYNONYM file.

Regulatory information pertaining to individual chemicals is stored in the CAS file. All the EPCRA TPQ's and RQ's are assigned on a chemical basis, as are most environmental regulatory limits. Some regulations are based on the attributes of the hazardous material and not its individual components. An example is hazardous waste characteristics: ignitability, corrosivity, and reactivity. Data pertaining to the hazardous material as a whole is stored in the PRODUCT file.

Data Output.

Data can be obtained from the tracking system three different ways: Queries, Reports, and Batch processing programs. Most commercially available Data Base Management Systems include the capability to perform queries, generate reports or run batch processing programs. The DBMS installed on the shipyard's LAN is a hierarchical database, not fully relational. The lack of full rationality limits the query capability and causes the need to use the report generator or batch processing programs to a greater extent.

The simplest way of obtaining data is by querying, or conducting a 'conditional search' of the database. In a query, the user simply enters the program and calls up one of the data screens. The user then enters the conditions of the search they want to perform by filling a data field or fields. The use of multiple data fields in a query are used to narrow a search. The appropriate key sequence is then entered to start a search. The output of a search can appear either on the computer screen, or be printed on a connected printer.

More complicated searches can be performed by using the report generator. The report generator also allows for greater flexibility in designing how the output will appear. The report generator is needed when several different data files are involved in a search. When the search criteria becomes too complex for a report generator to handle, batch processing programs are needed. A batch processing program is an actual computer program, written in the computer language supplied with the DBMS. Some DBMS's allow for the use other computer languages.

DATA FLOW

Hazardous materials enter the facility either under a shipbuilding contract, a shop order, or from purchase from a local merchant, such as a hardware store. Contractual

and shop order materials are purchased through the issuance of a purchase order (P-0.). Purchase orders are generated on a mainframe computer system which in turn, creates a notice to the Receiving Department to expect a shipment. When material arrives at the shipyard, the Receiving Department generates an inspection report utilizing P.O. information and compares the material received against the information on the P.O.. If the material matches the P.O. description and is not damaged, the material is accepted and a receipt of material received report is generated.

When purchase orders are issued for materials that might be hazardous materials, a statement about Material Safety Data Sheets is included on the P.O.. The statement requests that the vendor either supply MSDS's (one prior to shipment and one with the shipment) or a statement that the material does not require a MSDS. All copies of MSDS's sent by vendors prior to a material's shipment are routed to the Environmental Affairs Department. Each MSDS received by the Environmental Affairs Department is checked to see if it is for a new hazardous material, an updated MSDS for a currently used hazardous material, or a duplicate of an MSDS that is already on file (not an update). If the MSDS is for a new hazardous material, a product code is assigned to the hazardous material. All pertinent data on the MSDS is transcribed into the PRODUCT and COMPONENT files of the Hazardous Material Tracking System.

When material arrives at the shipyard, warehouse personnel route all materials that are hazardous to a special hazardous materials warehouse. At this warehouse, the containers of hazardous material are labeled with the one inch by two inch tracking label. The label is affixed as close to the container label as possible. The warehousemen then enter the receipt of the material into the tracking system. Product codes are assigned to the received materials by

examining a computer list of possible product codes. The list is sorted by product name, manufacturer, and product code to assist the proper product code assignment. If a problem arises with assigning a product code, the warehouseman calls the Environmental Affairs Department. At present, only hazardous materials that are packaged in containers one gallon in size or larger are tracked.

When a hazardous material is requested by a shop, the warehousemen deliver the materials and enter information about the movement into the tracking system; the date and time of the delivery, receiving location and department, the employee number of the person who requested the material, and the container numbers of the moved material. Once a hazardous material is out of the warehouse, it is the responsibility of the department that received the material to record further movements, transfers or when the container is empty. All containers are considered as being either full or empty, although the tracking system has the capability of recording fractional use. Other 'transactions' that the tracking system can recognize are: transfer from a container into a tank; refill of a container (complete or fractional); the appearance of a container from an unknown origin; and off-site transfer of a container (such as shipment for disposal).

When a container is recorded as empty, the department in control of the material affixes a round fluorescent pink label to the container, close to the tracking label. Facility personnel have been instructed to hold any tracked container being discarded without the pink circle and to inform the Environmental Affairs Department. This prevents any tracked container from being discarded prior to being recorded in the tracking system as empty.

DISCUSSION

The development of the hazardous material tracking

system was performed in only a two month time frame. With such a short period of time allotted for development, problems were expected to occur. Surprisingly, few major problems occurred related to the database design. Database design problems consisted mostly of such items as inefficient screen layouts, or failure to make certain data fields mandatory when information was entered.

One significant problem involved the CONTAINER file. The original plan for this file was to remove and archive data on empty containers on a yearly basis. Unfortunately, the number of containers tracked was larger than expected and this file became unwieldy. Queries of the CONTAINER file started taking too much time to be useful should an emergency arise. The solution, presently being implemented, was to split this file in two. One file will hold data on non-empty containers. The other file will hold data on empty containers.

Certain problems arose with Material Safety Data Sheets. An assumption was made that there would be a one-to-one correspondence between products and MSDS's. This was true for the most part, but exceptions were found, especially with coatings. There were several instances where several coatings had one MSDS, such as the F150 series of paints. Some coatings also had more than one MSDS that could apply. For instance, there is a MSDS for the F150 through F159 series paints and a MSDS for an F153 paint.

Multiple component systems presented problems that have yet to be resolved. Some multiple component systems have separate MSDS's for each component, some only have one MSDS for the components as a whole. Decision criteria need to be devised to decide how to track multiple component systems. Should each component be tracked separately, or should the system be tracked as a kit?

Data entry has also presented some problems. Delays in data

entry have caused the container inventory to be inaccurate. Some container history records show a container being emptied before it was ever moved out of the receiving warehouse. Worse yet, some containers were transferred into one of the yards and were consumed before they were ever entered as being received. When the manufacturing department vent to enter the container as being consumed, they could not find a record for the container.

A monthly inventory reconciliation program will be initiated soon to overcome tracking errors. At present, there is not a formal inventory reconciliation procedure in place at the shipyard. One partial check was made in June of 1989, which showed a error rate of approximately eight percent. Reports will be sent to each department that has tracking responsibilities each month. Each department will compare their physical inventory against the tracking system inventory and report any deviations.

Some products were received prior to a MSDS being received and a product code being assigned. The warehousemen could not find a product code to assign the received containers. This problem was solved by assigning a product code with minimal information entered into the system. A phone call would be made to the manufacturer or vendor, requesting that an MSDS be faxed immediately.

Personnel turn over presented some nagging problems with the tracking system. Some key people were lost and the data entry burden had to be picked up by others while a new person was trained. In one instance, a person was lost and the department never reassigned a person to perform data entry duties. An inventory report spotted an unusually large inventory for that department. Investigation showed that the consumption of containers had not been entered into the tracking system.

Currently containers of hazardous materials are only recognized as being either empty or full. Partial consumption, or draw down of containers is not recorded although the tracking system has this capability. There are plans to add a tool room for the distribution of paint and paint solvents. A tool room is necessary to gain the control needed to track partial consumption. The driving force behind the creation of the paint tool room are requirements from the state environmental regulatory agency to record Volatile Organic Compounds and air toxics emissions more precisely than in the past.

RECOMMENDATIONS

Before implementing a tracking system, be sure to get the input of all departments that have to or may use the system. This will make them feel a part of the process and gain support for the system. There is also a wealth of knowledge that can be tapped. Many people at the shipyard offered excellent suggestions on how to improve the system by adding features they could use and making the system easier to use.

Several departments fought the development of the tracking system at first. Expect to have to perform some lobbying for the system. Point out the benefits of a tracking system. Several manual inventory systems were replaced, and manufacturing departments have the luxury of knowing their inventories at a few keystrokes. The purchasing department has found the system to be of benefit by checking inventory prior to ordering consumables that may have short shelf life.

If at all possible, purchase a fourth generation, fully relational DBMS for the tracking system. These advanced DBMS's should allow for easier development and the ability to obtain most of the information you need by query instead of report generators or batch processing programs.

ACKNOWLEDGEMENTS

The authors thank the following people for their contribution to the development of the Hazardous Materials Tracking System.

Mr. Gary Higgins

Mr. Gerald Huber

Mr. Steve Pope

Mr. Tim Ullman

REFERENCES

1. J. Gordon Arbuckle, Timothy A. Vanderver Jr., Paul A. J. Wilson, Emergency Planning and Community Right-To-Know Handbook, second edition, Rockville, MD, Government Institutes, Inc., 1987.
2. Chemical Guide to SARA Title III, edited by Kenneth B. Clansky and Janis M. Adkins, Burlingame, CA, Roytech Publications, Inc., 1989.
3. James Martin and Carma McClure, Software Maintenance: The Problem and It's Solution, Englewood Cliffs, NJ, Prentice-Hall, Inc., 1983
4. Gerald A. Rich, "Environmental Software Review: 1989, Pollution Engineering, January 1989.

Additional copies of this report can be obtained from the
National Shipbuilding Research and Documentation Center:

<http://www.nsnet.com/docctr/>

Documentation Center
The University of Michigan
Transportation Research Institute
Marine Systems Division
2901 Baxter Road
Ann Arbor, MI 48109-2150

Phone: 734-763-2465
Fax: 734-763-4862
E-mail: Doc.Center@umich.edu