# THE CHEMICAL SAFETY AUDIT PROGRAM:

# FY 1999 STATUS REPORT

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## EXECUTIVE SUMMARY

This is a comprehensive report on the status of the U.S. Environmental Protection Agency's Chemical Emergency Preparedness and Prevention Office's (CEPPO) Chemical Safety Audit (CSA) program since its inception in fiscal year (FY) 89, a review of the successful and problematic trends of CSA program implementation in FY 99, and a discussion of the current and future role of the CSA program in the CEPPO Prevention Strategy.

In these eleven years, the CSA program has encompassed the review of the chemical process safety management systems of 382 facilities and the training of over 1400 federal, state, and local officials. In addition, the CSA program has developed a database of chemical safety audit information and supported numerous other related chemical accident prevention activities, including outreach and technical assistance for both the public and private sector.

Chemical accident prevention involves identifying the causes of accidental releases of hazardous substances and the means to prevent them from occurring, promoting industry initiatives in these areas, and sharing the results with the community, industry, and other interested groups. EPA established the CSA program to:

- Heighten awareness of and promote chemical safety among facilities handling hazardous substances, as well as in communities where chemicals are located;
- Build cooperation among facilities, EPA, and others by conducting joint audits;
- Gather information on safety practices and technologies from facilities handling hazardous substances; and
- To establish a database for the assembly and distribution of chemical process safety management information obtained from the facility audits.

The CSA program is not a compliance or regulatory program; however, EPA does have legal authority for entering a facility and conducting a chemical safety audit under sections 104(b) and 104(e) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The audit consists of interviews with facility personnel and an on-site review of various aspects of facility operations related to the prevention of accidental chemical releases. Observations and conclusions from the audit are detailed in a report, available to the public, that identifies both problematic and successful chemical process safety management practices, as well as technologies for preventing and mitigating chemical releases.

This status report is intended to provide EPA headquarters and regional management with a better understanding of how the program is being implemented both at headquarters and in the regions, the purpose and goals of the audit program, and the type of information being generated and its uses. The following four topics are the focus of this report — program activities, program results, regional program implementation, and analysis of audit results.

**Regional Implementation Status**

In addition, the CSA program has provided the opportunity for greater cooperation and communication with state and local officials as a result of their participation in the audit process and associated training and outreach activities. State and local audit participants stress the beneficial aspects of the program from increased government-industry coordination to enhanced understanding of chemical process safety issues in the community. In addition, as the CSA program has developed, the regional offices have initiated new programs and activities and introduced modifications to audit procedures that take advantage of the program's flexibility. Initiatives such as mini-audit programs and accident investigations, as well as greater pre-audit planning, coordination with other environmental and health and safety programs, and outreach to industry, have also been the products of the evolution of the CSA program. For example, in FY 99, Region 3 conducted 17 mini-audits.

**Program Activities/Results**

The achievements of the audit program, outlined in Chapter 2, are based on the number of full-scale audits conducted and reports completed in each region, along with a summary of the audits by the facility's Standard Industrial Classification (SIC) code and by the hazardous substances examined during the audit. An overview of participation in training workshops offered by EPA headquarters is included.

As of the close of FY 99, the regions had submitted a total of 373 final reports to EPA headquarters for the 382 full-scale chemical safety audits that were conducted between FY 89 and FY 99. Information from the 10 most recently submitted reports was examined for this status report.

CEPPO has designed a four-day chemical safety audit workshop that gives potential audit team members the training to conduct an audit; beginning in FY 93, these courses have been presented by EPA's Environmental Response Team as part of their training curriculum. From 1989 through 1999, a total of 75 workshops, attended by over 1800 individuals throughout all ten regions, have been conducted; 146 individuals attended the eight workshops held in FY 99. The most noteworthy trend in these workshops has been the increased involvement of state and local officials, who account for approximately 52 percent of the overall attendance, but 69 percent of the attendees in the past year. This represents a concerted effort within the CSA program to increase awareness and participation by these individuals in combination with increasing state and local interest in chemical process safety issues.

To realize the goals of the CSA program to collect and disseminate information on chemical process safety issues and to improve program coordination, CEPPO has assembled a computerized database to provide EPA regions and headquarters (as well as state and local government agencies) with information gathered from chemical safety audit reports in a format consistent with the CSA protocol. Through analysis of the database, the user can identify successful and problematic techniques or practices employed to manage process safety at facilities handling hazardous substances. The database is being used by CEPPO to develop guidance and technical assistance documents that will be distributed to individuals and organizations involved in chemical accident prevention. In addition, the database has been given to federal, state, and local officials attending the training workshops, who use the audit report information to increase their familiarity with chemical process safety issues and to support their own inspection and auditing activities.

**FY 99 Audit Analysis**

Chapter 3 presents an overview of conclusions and recommendations taken from recent EPA chemical safety audits, based on the latest 10 final CSA reports received by EPA headquarters as of September 30, 1999. Once again, the results have been organized according to the major elements of generally accepted chemical process safety management practices, which form the basis for the facility risk management programs specified under Clean Air Act (CAA) section 112(r). Sixteen major chemical process safety elements are examined in this chapter: corporate and facility management, process hazard analysis (hazard evaluation), offsite consequence analysis, process safety information, standard operating procedures, equipment and instrument maintenance, training, safety audits, accident investigation, management of change, hot work permits, employee participation, contractors, release prevention and mitigation measures, facility emergency preparedness and response, and community emergency response coordination.

Each section of Chapter 3 reviews the key features in the implementation of one of these chemical process safety elements, as well as the role each element plays in maintaining a safe facility. After an overview of general trends in audit team observations and conclusions from the last several years, each section highlights notable facility practices taken from the latest 10 audit reports. For example, most of the audited facilities have developed procedures for conducting investigations of certain accidental releases of hazardous substances. However, the audit teams visiting these facilities noted very significant differences in the range of releases that were investigated, the scope of the investigation, the process of implementing corrective action and follow-up procedures.

**Chemical Safety Audits and Risk Management Program**

On May 24, 1996, EPA's Administrator signed the final rule for the risk management planning requirements mandated under Clean Air Act (CAA) section 112(r). The rule requires certain facilities ("sources") handling regulated substances in a process above specific quantities to develop and implement a risk management program consisting of a hazard assessment, a prevention program, and an emergency response program. Sources will summarize their risk management program in a risk management plan (RMP), which will be made available electronically to state and local government and the public. Sources with processes covered by the RMP rule must have complied with these requirements by June 21, 1999. EPA and the other agencies responsible for implementing these regulations are required to conduct audits of RMPs and will also conduct site inspections to oversee and enforce compliance with the rule by evaluating actual practices.

The chemical accident prevention practices which the CSA program encouraged are now mandatory for facilities covered by the RMP rule. EPA has been encouraging state governments to take responsibility for implementing the RMP program, and several states have received delegation of the program. The CSAs in the Regions have been curtailed as the Regions shifted resources toward implementing RMP and assisting states with guidance, training, and technical assistance on chemical process safety issues and the audit process.

The RMP audits and site inspections will replace most of the CSAs. Nevertheless, the CSA program continues to be a tool that some Regions may use to promote chemical safety. The CSA program, the Risk Management Program, and the Clean Air Act General Duty Clause are components of EPA’s integrated chemical safety program. Depending on the circumstances at a particular facility, EPA may choose to apply one or more of these elements to achieve greater protection of human health and the

environment.

# 1.0 CHEMICAL SAFETY AUDIT PROGRAM: HISTORY AND FUTURE

In the eleven years since EPA initiated the Chemical Safety Audit (CSA) program in 1988, over 382 full-scale chemical safety audits and approximately 180 mini-audits have been conducted by EPA regional offices. In addition, an extensive training program has been established and a CSA program database has been developed. The CSA program also has prompted a growing interest among state and local officials in the audit process and in the underlying concepts of chemical process safety management. With the publication of the final risk management planning regulations mandated under section 112(r) of the Clean Air Act (CAA), the CSA program has assumed a critical support role in the development of the national chemical accident prevention effort spearheaded by EPA's Chemical Emergency Preparedness and Prevention Office (CEPPO).

For the 382 full-scale chemical safety audits conducted over the ten years ending September 30, 1999, 373 final audit reports have been prepared (see Appendix B). To compile information for this report, the final audit reports have been summarized in a standard format consistent with the CSA protocol. These profiles present a summary of audit observations and include the audit team's conclusions and recommendations. The profiles also contain information on facility name, location, primary processes, and product(s); the hazardous substances examined for the audit; and the name, affiliation, role, and expertise of each audit team member.

The remainder of this chapter describes the future of the CSA program and the primary features of the existing CSA program, including its history and purpose, and key program activities — CSA training workshops and the CSA database. Chapter 2 presents a statistical overview of the results of CSA program activities and achievements. Lastly, Chapter 3 reviews facility chemical process safety practices identified in the final CSA reports submitted to CEPPO since the publication of the FY 98 CSA Status Report.

## 1.1 Program Background

History

The CSA program is part of a broad EPA initiative designed to accomplish four chemical accident prevention goals:

- Learn about and understand problematic and successful practices and technologies for preventing and mitigating releases from facilities handling hazardous substances;
- Heighten awareness of chemical safety among chemical producers, distributors, and users, as well as in communities where chemicals are located;
- Build cooperation among authorized parties by coordinating joint audits where appropriate; and
- Establish a database for the assembly and distribution of chemical safety information obtained from facility audits and from other sources.

Following the 1984 release of methyl isocyanate in Bhopal, India, and subsequent incidents in the United States, awareness of the threat to public safety posed by similar incidents led to an emphasis on preparedness and planning for response to chemical accidents. EPA established the Chemical Emergency Preparedness Program to help states and communities plan for chemical emergencies. Many

of the features of this voluntary program were incorporated into SARA Title III, which establishes a chemical emergency preparedness infrastructure within each state, territory, and Tribal land.

Recognizing accident prevention as the next step after instituting local emergency preparedness efforts, EPA sought to identify causes of accidental releases of hazardous substances and the means to prevent them from occurring, to promote accident prevention practices in industry, and to share information with the community, industry, and other groups (e.g., academia, professional organizations, trade associations, labor, and environmental groups). Many of these key concerns were identified in the Congressionally mandated SARA Title III section 305(b) study, *Review of Emergency Systems*. This study reviewed technologies, techniques, and practices for preventing, detecting, and monitoring releases of extremely hazardous substances, and for alerting the public to such releases. As part of the information-gathering needed to prepare this study, a number of facility audits were conducted to evaluate, first-hand, their chemical process safety management practices. As one method of acquiring additional information and encouraging awareness of accident prevention at facilities, the study recommended that EPA continue the program of facility audits, thus inaugurating the CSA program.

Authority

While the CSA program is not a compliance or regulatory program, EPA does have legal authorities for entering a facility and conducting a chemical safety audit. The primary authority for EPA and its designated representatives to enter a facility and review its records and operations is contained in CERCLA sections 104(b) and 104(e). The audits are intended to be non-confrontational and positive, so that information on safety practices, techniques, and technologies can be identified and shared between EPA and the facility. If serious problems are discovered during the audit, however, EPA may use a variety of legal authorities to address them.

Audit Team

An EPA audit team consists primarily of EPA employees and other designated representatives, including contractors and AARP members. Other federal, state, and local government personnel, particularly representatives of State Emergency Response Commissions (SERCs) and Local Emergency Planning Committee (LEPCs) established under EPCRA, are encouraged to participate in audits as team members or observers. The audit team can vary in size depending on the scope of the audit and the expertise of individual team members. Although states and local governments must use their own authorities for audit participation, the CSA program encourages the involvement of LEPC and SERC members throughout the audit process.

Audit Selection

In selecting a facility for a chemical safety audit, the EPA regional office may consider a number of factors, including but not limited to the hazardous substances used, the facility's history of releases, the facility's proximity to a sensitive population or area of high population density, its accident prevention technologies, or the industry's concentration in the area. The regional office may review federal, state, and local release notification reports and follow-up reports; On-Scene Coordinator (OSC) reports; Regional Response Centers; Accidental Release Information Program (ARIP) reports; and other sources. Currently, most facilities selected have been identified based on their history of accidental releases, using ARIP, the Emergency Response Notification System (ERNS), and other release information sources.

At present, EPA regional offices are not required to follow any formal procedures when selecting a facility for an audit, as long as the following two important requirements are met:

- Under CERCLA, EPA may enter a facility only if a release of a CERCLA hazardous substance, pollutant, or contaminant has occurred at the facility, or there is "reason to believe" that a threat of such a release exists; and

- The Office of the Regional Counsel and the SERC must be consulted to identify any legal actions currently being pursued or anticipated against the audited facility. Although not compliance-oriented, a chemical safety audit conducted at a facility where legal action is on-going or anticipated may interrupt or otherwise have an impact on the settlement process. It is also suggested that other regional program offices be consulted.

EPA can enter a facility and conduct an audit at the invitation or voluntary consent of the facility's management.

Audit Process

The audit consists of interviews with facility personnel and on-site review of various aspects of facility operations related to the prevention of accidental chemical releases. Observations and conclusions from the audits are detailed in a report prepared by the audit team. The report identifies and characterizes the strengths and weaknesses of specific chemical accident prevention program areas to recognize particularly effective programs and to share information on problematic practices. Copies of the report are given to the facility and its corporate management to point out weak and strong program areas.

The audit is conducted in accordance with the *Guidance Manual for EPA Chemical Safety Audit Team Members*, which contains mandatory procedures, as well as recommended actions, to follow to ensure the health and safety of program auditors and program integrity. Each member of the audit team should have a copy of the manual, and a copy of the manual should be sent to the facility prior to the audit. The guidance manual also contains an audit protocol, a detailed outline that directs the scope and content of the audit and establishes a structure for preparing the audit report. The protocol is designed to provide CSA teams with an organized and detailed format for conducting an audit and preparing a comprehensive report. By following the protocol in preparing CSA reports, regional staff ensure continuity and consistency in report preparation.

### 1.2 Relationship to the CEPPO Prevention Strategy

The CSA program is one component of CEPPO's overall chemical accident prevention strategy. The key to the success of the CSA program in supporting accident prevention is the cooperation built between industry and EPA through the voluntary audit participation. The voluntary nature of the audits encourages facilities to work with EPA and allows industry to feel comfortable in sharing their audit experiences and recommendations with other industry partners. Another important factor is the ongoing coordination of the CSA program with other CEPPO prevention efforts including the Accidental Release Information Program (ARIP), the Risk Management Plan (RMP) program, and the chemical accident investigation (CAI) program:

- In 1986, the ARIP program began to collect accident information through surveys issued

to certain facilities experiencing accidental releases. The ARIP database, consisting of information taken from the ARIP survey, is used to identify candidate facilities for chemical safety audits and other prevention-related outreach programs.

- With the passage of the Clean Air Act Amendments of 1990, EPA began development of the RMP rule, in part using the information provided by ARIP and CSA. Since promulgating the RMP rule in 1996, CEPPO has been working to implement the RMP program. Regional chemical safety audit team members are involved in all the facets of the RMP program, including assisting CEPPO in developing guidance documents, providing assistance to personnel from state and local implementing agencies, and working directly to help facilities understand the requirements.

- EPA's statutory responsibility for the prevention and mitigation of accidental releases necessitates action by the Agency to investigate and understand the chemical accidents that occur. These investigations, conducted by EPA's Chemical Accident Investigation Team (CAIT), may lead to issuance of new guidance or regulations relating to accident prevention. Chemical safety audit team members provide critical support to the CAIT. Team members are involved in conducting accident investigations; developing safety alerts where an unrecognized hazard is identified; and developing reports on the facts, circumstances, and root causes of accidents.

The regional offices have substantial flexibility in implementing the CSA program. The regions have used this flexibility to model the CSA program into a vehicle for meeting regional priorities for accident prevention. Specific features of the CSA program (e.g., followup activities) have served as the basis for the development of new regional initiatives. In addition, several regions have begun separate chemical-specific initiatives to address commonly used hazardous chemicals that pose the greatest risk in an accident, such as mini-audits. In FY 99, Region 3 conducted 17 "mini" chemical safety audits. By performing "mini" audits, the regions were able to reach a larger number of facilities at a reduced cost to the government.

### 1.3 Future Role of the CSA Program

On May 24, 1996, EPA's Administrator signed the final rule for the risk management planning requirements mandated under Clean Air Act (CAA) section 112(r). The rule requires facilities handling regulated substances in a process above specific quantities to develop and implement a risk management program consisting of a hazard assessment, a prevention program, and an emergency response program. Facilities will summarize their risk management program in a risk management plan (RMP), which will be made available electronically to state and local government and the public. Sources with processes covered by the RMP rule must comply with these requirements by June 21, 1999.

In addition, according to Clean Air Act (CAA) section 112(r), EPA and the other agencies responsible for implementing these regulations are required to conduct audits of RMPs and site inspections to oversee and enforce the compliance of the rule by evaluating actual practices.

In the Regions, the resources previously used for carrying out CSAs have, for the most part, been redirected to meet the requirements set forth by the RMP. This is evident by the fact that, in the last two years, only three Regions have conducted CSAs. Each Region, based on its needs and resources available, will have the option of continuing to conduct CSAs. However, given the changes in the

regulatory landscape, the future role of the CSA will be limited.

RMP audits and site inspection procedures are in the process of being developed. There are also plans to document findings and lessons learned from the audits and inspections so that the information can be shared and applied to further accident prevention as had been done with the results of CSAs.

### 1.4 CSA Training Workshop

To provide guidance on the procedural and technical aspects of conducting an audit and to promote a better understanding of the objectives of the CSA program, EPA designed the Chemical Safety Audit program workshop. In FY 99, seven workshops were held in six regions. Training workshops were held at the Hanscom Air Force Base, MA (Region 1); Puerto Nuevo, PR (Region 2); Wilkes-Barre, PA (Region 3); Indianapolis, IN (Region 5); Chesterfield, MO (Region 7); San Francisco, CA (Region 9); and Sante Fe, NM (Region 9). A total of 146 attendees participated. A variety of groups was represented at the workshops including 18 regional personnel, 73 state officials, 28 local officials, and 11 representatives from other federal agencies, including staff from the U.S. Department of Labor, the U.S. Air Force,, the U.S. Public Health Service, the Army Corps of Engineers, and the American Red Cross.

The Environmental Response Training Program presents additional four-day CSA courses. These workshops are designed for presentation to a combination of regional, AARP, contractor, and state and local government personnel who are or will be involved in conducting chemical safety audits. The topics addressed during the current four-day workshop include:

- Chemical process hazards
- Process safety management
- Computer modeling
- Process safety: equipment
- Process safety: operations
- Hazard and release mitigation
- Maintenance procedures and training requirements
- Conducting interviews
- Incident investigation
- Hazard evaluation
- Hazard evaluation techniques
- Emergency response
- Process inspection techniques

- Audit report writing
- *Guidance Manual for EPA Chemical Safety Audit Team Members*
- *Chemical Safety Audit Program Resource Guide*

In addition, a series of sequential group exercises is held during the workshop to provide participants with the opportunity to apply theoretical knowledge to scenarios that simulate all phases of conducting a chemical safety audit, including interviewing facility personnel.

### 1.5 CSA Database

To collect and disseminate information on chemical process safety issues and improve program coordination, CEPPO has assembled a computerized database to provide EPA regions and headquarters (as well as state and local government agencies) with information gathered from chemical safety audit reports in a format consistent with the CSA protocol. The profiles present a summary of audit observations and include the audit team's conclusions and recommendations. The profiles also contain information on facility name, location, primary processes, and product(s); the hazardous substances examined for the audit; and the name, affiliation, role, and expertise of each audit team member. The information in the database is useful to EPA regional offices for a variety of purposes, such as identifying field experts and comparing processes and safety practices at different facilities for the same chemicals. Although the database is not directly available to the public and industry, EPA will use it to develop guidance and technical assistance documents that will be distributed to individuals and organizations involved in chemical accident prevention.

The database has been given to interested federal, state, and local officials who have attended CSA training workshops. These individuals are using the database as a source of background information on chemical hazards, process hazards, and successful and problematic facility practices in preparation for their own inspection and auditing activities. For example, by reviewing the information on typical operating hazards and release prevention practices at the paper mills contained in the CSA database, these officials have been better prepared to conduct inspections of similar paper mills under their own jurisdiction.

The CSA database makes it possible to examine audit information about specific facilities quickly. For example, the database user can easily examine and compare audit observations and recommendations for facilities that use similar chemicals, that manufacture similar products, or that are located in the same EPA region. Users can search the database for different types of information, such as chemical names or Chemical Abstract Service (CAS) numbers, SIC codes, processes, and process safety practice or technique, or a combination of fields. For example, a user could search the database to identify the type of containment systems present at chemical manufacturing facilities (SIC code 28) that use chlorine. EPA regional and headquarters personnel (as well as other federal and state and local officials implementing similar programs) can also use the database to:

- Identify field experts for auditing advice or participation in an audit;
- Identify facilities with similar processes or practices to support an ongoing audit;

- Compare successful or problematic safety practices among similar facilities;
- Identify previous recommendations for a similar process safety practice or technique;
- Compare safety equipment among similar facilities; and
- Assemble information on a specific chemical safety process management practice.

The current version of the CSA database, distributed in July 1996, contains profiles of 312 chemical safety audits.

## 2.0 OVERVIEW OF CSA PROGRAM RESULTS

This chapter presents an overall summary of the achievements of the Chemical Safety Audit program focusing on the following subjects:

- Chemical safety audits and audit reports completed in each fiscal year;
- Breakdown of the audited facilities by Standard Industrial Classification (SIC) code;
- Hazardous substances examined by the audit teams; and
- Chemical safety audit training workshops conducted.

### 2.1 Chemical Safety Audits and Reports Completed

As of the close of FY 99, the regional offices have finalized a total of 373 audit reports for the 382 full-scale chemical safety audits, including several follow-up audits for which no audit report profile was prepared. Exhibit 1 displays totals for the number of chemical safety audits that the regional offices conducted during each fiscal year. The number of reports completed by each regional office is also included. The chart indicates that 32 full-scale chemical safety audits were completed in FY 89, 39 in FY 90, 53 in FY 91, 41 in FY 92, 57 in FY 93, 57 in FY 94, 44 in FY 95, 27 in FY 96, 13 in FY 97, 9 in FY 98, and 10 in FY 99. Exhibit 2 summarizes the chemical safety audits and final reports completed by region. In addition, note that these totals do not include the mini-audits conducted by the regional offices in the last three years; in FY 99, Region 3 conducted 17 mini-audits.

### 2.2 Chemical Safety Audits by SIC Code

Approximately half of the chemical safety audits conducted by the regional offices involved chemical manufacturing operations (SIC code 28). Exhibit 3 presents a breakdown, by SIC code, of the 373 audited facilities for which this information is available. (Some facilities' operations are categorized in more than one SIC code, a characteristic that is reflected in the exhibit.) Within SIC code 28, the vast majority of the processes examined were further classified under SIC codes 281, 282, 286, and 287. Other manufacturing operations at which a number of audits were conducted are paper and pulp mills — SIC code 26 (29), petroleum refineries — SIC code 29 (27), food processors — SIC code 20 (26), primary metal manufacturing — SIC code 33 (15), and electronic and electrical equipment manufacturing — SIC code 36 (16).

Non-manufacturing operations at audited facilities comprise approximately one-seventh of the total number of audits and are classified in a variety of SIC codes. The major categories among these operations are nondurable goods wholesalers handling hazardous substances — SIC code 51 (22); electric, gas, and sanitary services — SIC code 49 (10); and public water treatment facilities — SIC code 95 (8).

**Exhibit 1**

# Number of Chemical Safety Audits and Chemical Safety Audit Reports by Year and by Region

**FY 89 through FY 99**

| Region | FY 89 Audits | FY 90 Audits | FY 91 Audits | FY 92 Audits | FY 93 Audits | FY 94 Audits | FY 95 Audits | FY 96 Audits | FY 97 Audits | FY 98 Audits | FY 99 Audits | Total Audits | Total Reports |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 4 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 20 | 19 |
| 2 | 2 | 4 | 3 | 3 | 4 | 3 | 2 | 4 | 4 | 0 | 1 | 30 | 27 |
| 3 | 4 | 4 | 4 | 5 | 6 | 6 | 4 | 2 | 0 | 0 | 0 | 35 | 33 |
| 4 | 5 | 5 | 5 | 6 | 10 | 8 | 8 | 6 | 5 | 5 | 8 | 80 | 79 |
| 5 | 3 | 5 | 3 | 3 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 29 | 24 |
| 6 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 30 | 29 |
| 7 | 0 | 0 | 4 | 6 | 14 | 18 | 14 | 4 | 4 | 4 | 1 | 70 | 69 |
| 8 | 3 | 4 | 6 | 4 | 5 | 4 | 3 | 0 | 0 | 0 | 0 | 29 | 22 |
| 9 | 4 | 4 | 4 | 4 | 3 | 3 | 1 | 3 | 0 | 0 | 0 | 26 | 26 |
| 10 | 3 | 4 | 5 | 3 | 4 | 4 | 4 | 5 | 0 | 0 | 0 | 33 | 33 |
| Total | 32 | 41 | 42 | 41 | 57 | 57 | 44 | 27 | 13 | 9 | 10 | 332 | 311 |

**Exhibit 2**

# Summary of Chemical Safety Audits and Final Reports Completed by Region

**FY 89 through FY 99**

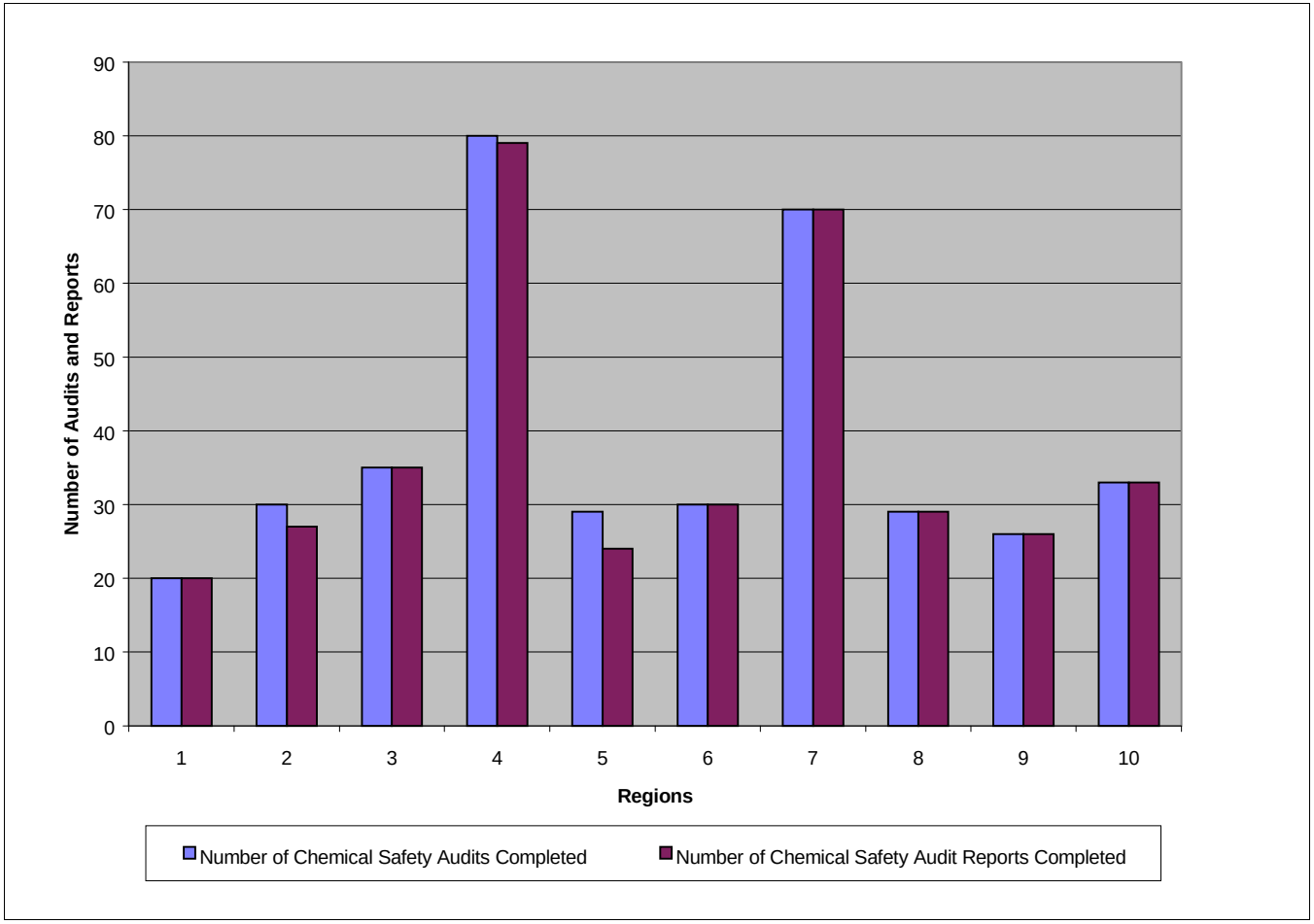
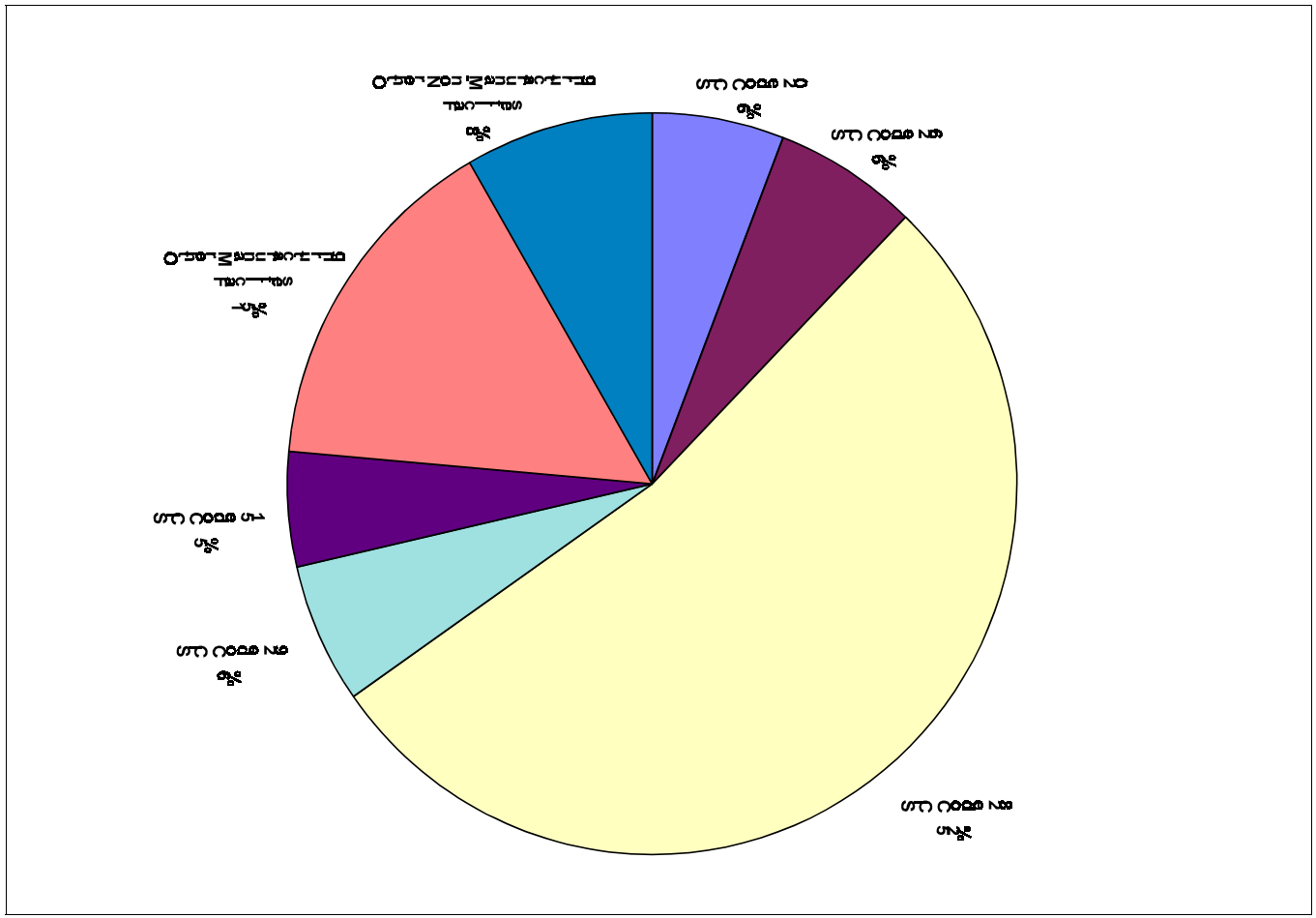


**Exhibit 3**

# Breakdown of Audited Facilities by SIC Code

**FY 89 through FY 99**



### 2.3 Chemical Safety Audits by Hazardous Substance

Approximately 200 different hazardous substances were examined by audit teams at the 382 audited facilities for which this information was available. About half of the substances are classified as CERCLA hazardous substances and a third are EPCRA extremely hazardous substances. Exhibit 4 presents a breakdown of the CERCLA hazardous substances and EPCRA extremely hazardous substances examined during the audits. On average, processes involving four hazardous and/or extremely hazardous substances were examined at each facility. The five most commonly examined substances were chlorine (131 audits), sulfuric acid (126), sodium hydroxide (106), ammonia (103), and hydrochloric acid (86).

### 2.4 CSA Training Workshops

From FY89 through FY99, 75 CSA workshops had been conducted in the EPA regions. Since FY 90, the host regions have been co-sponsors of the CSA workshops and provided valuable assistance in organizing and conducting the workshops. Hosting the workshop in cities near the locations of the regional office has allowed other EPA program offices and other federal agencies to attend. In addition, for the last seven years the regional offices have been coordinating with the states to identify workshop locations to encourage attendance by state and local officials.

This year, seven workshops were held in six regions. Training workshops were held at the Hanscom Air Force Base, MA (Region 1); Puerto Nuevo, PR (Region 2); Wilkes-Barre, PA (Region 3); Indianapolis, IN (Region 5); Chesterfield, MO (Region 7); San Francisco, CA (Region 9); and Sante Fe, NM (Region 9). A total of 146 attendees participated in the seven workshops. A variety of groups was represented at the workshops including 18 regional personnel, 73 state officials, 28 local officials, and 11 representatives from other federal agencies, including staff from the U.S. Air Force, the U.S. Department of Labor, the Army Corps of Engineers, the U.S, Public Health Service, and the American Red Cross. Exhibit 5 presents a breakdown of CSA workshop attendees by affiliation. Since FY 93, there has been a concerted effort within the CSA program to increase awareness and participation by state and local government representatives in the program. As is demonstrated in Exhibit 6, which compares the percentage of attendees by affiliation from FY 89 to FY 98 to that in FY 99, 69 percent of the FY 99 attendees represented state and local (includes tribal) governments, as compared to 51 percent in the previous years.

Exhibit 7 is a breakdown by region of the number of audit team members who have received training. State and local officials, EPA headquarters personnel, EPA headquarters contractors, industry and academia, and other federal agency representatives are not included in these figures. Four regions now have over 50 personnel who have been trained by attending a workshop; Region 4 (87), Region 3 (72), Region 2 (59), and Region 7 (51). Note that this exhibit does not include data for TAT workshop attendance since FY 94 because the technical assistance team contractors now support multiple regional offices.

**Exhibit 4**
# Hazardous Substances Examined
**FY 89 through FY 99**

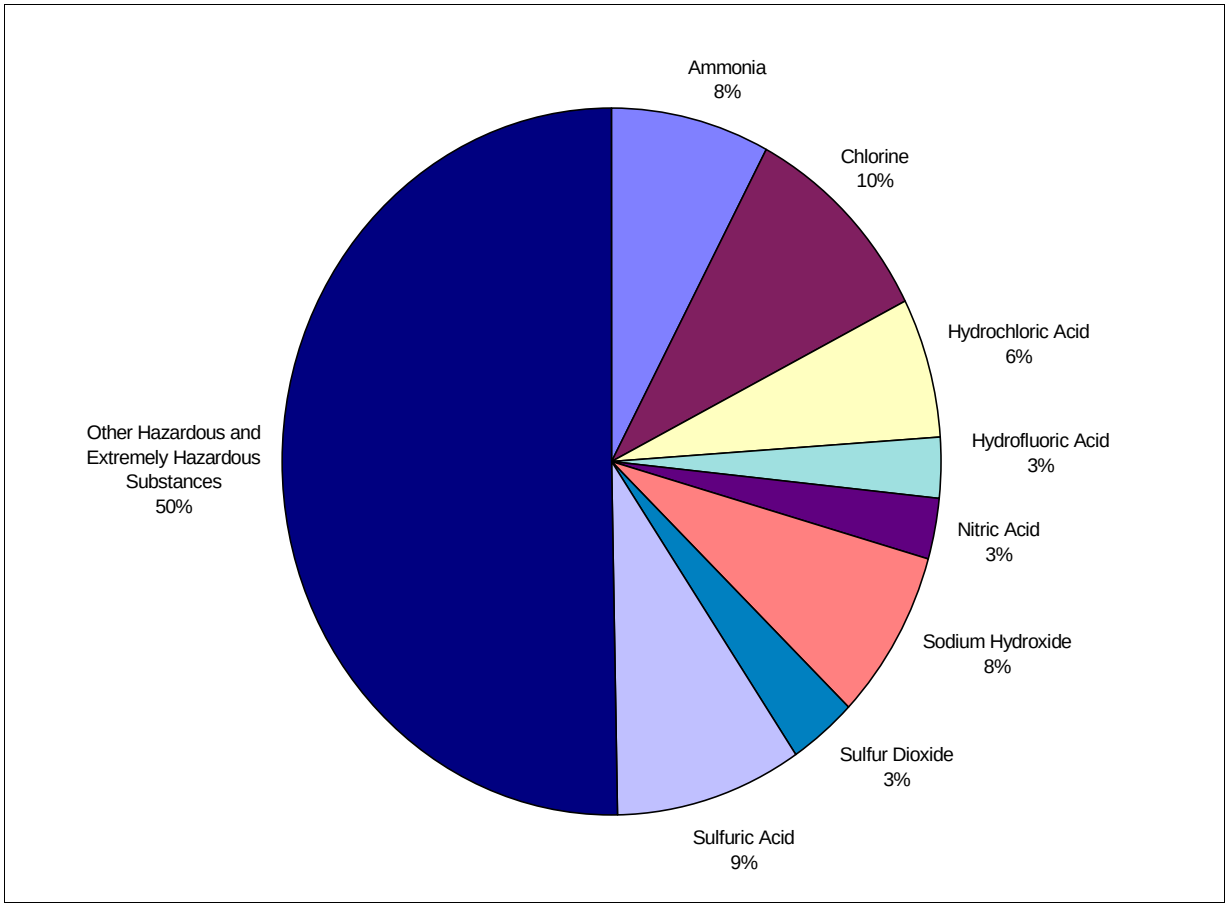


**Exhibit 5**
## Chemical Safety Audit Workshop Attendees by Affiliation
**FY 89 through FY 99**

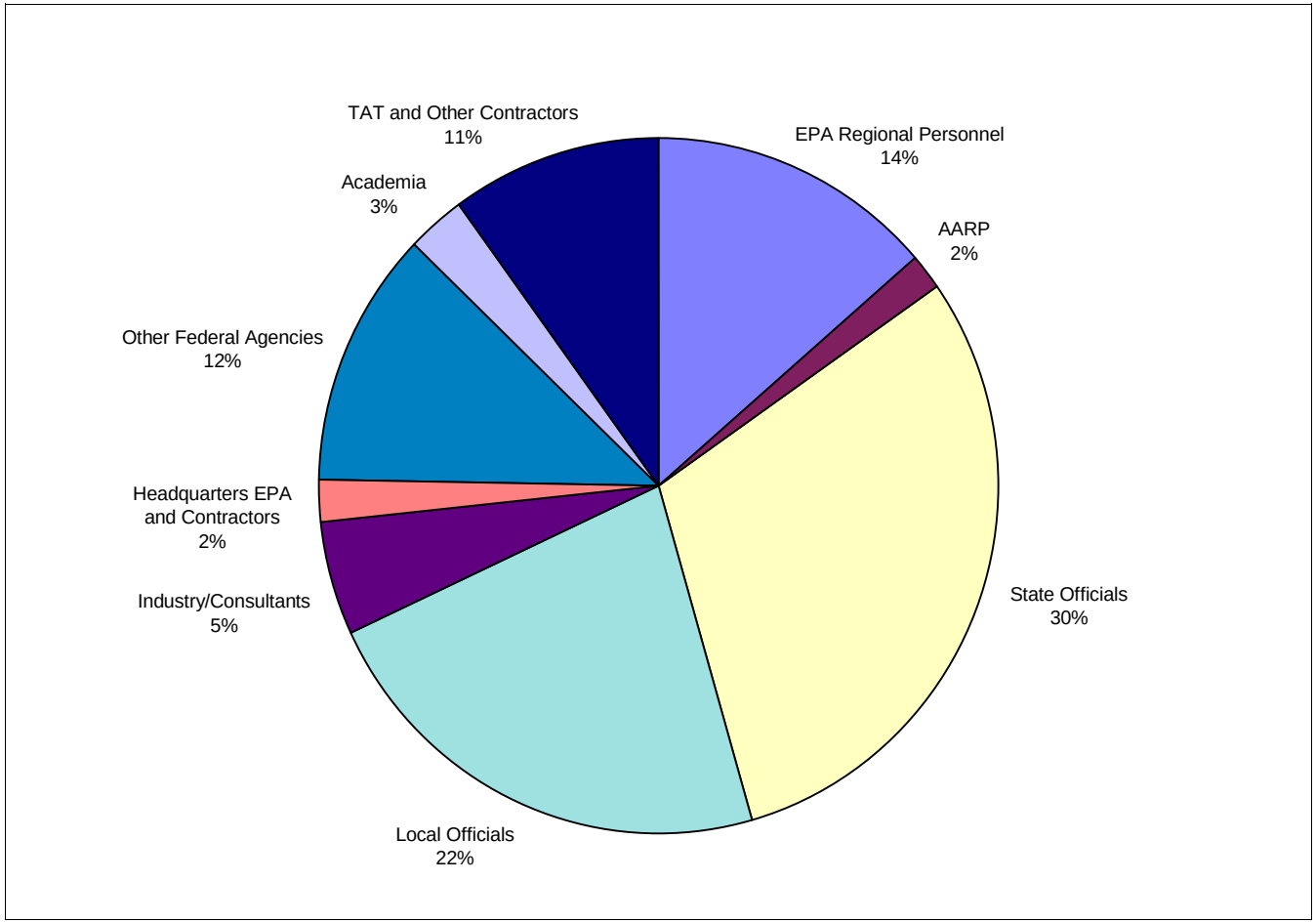
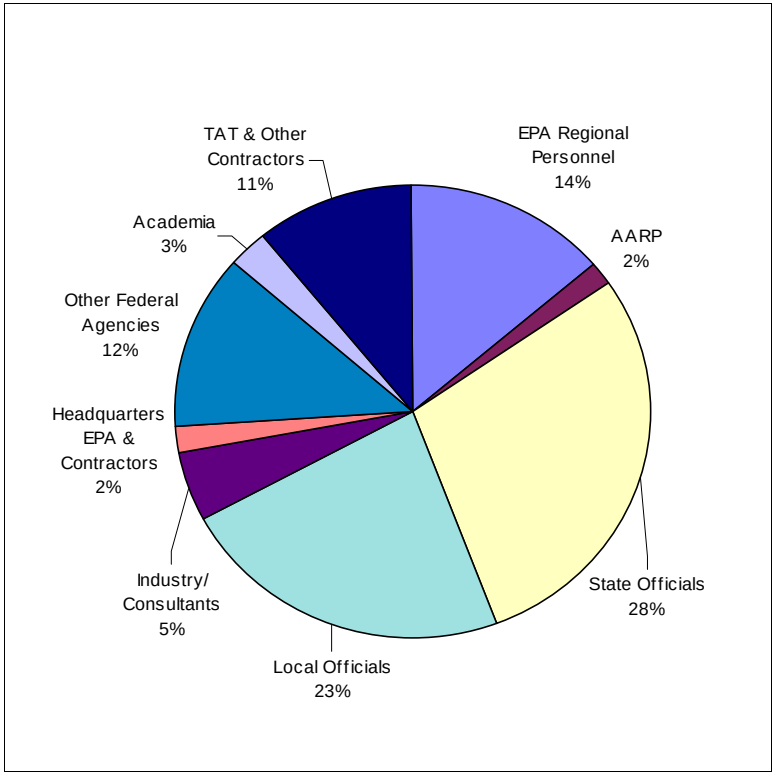


**Exhibit 6**

# Chemical Safety Audit Workshop Attendees by Affiliation

**FY 89 through FY 98**




**FY 99**

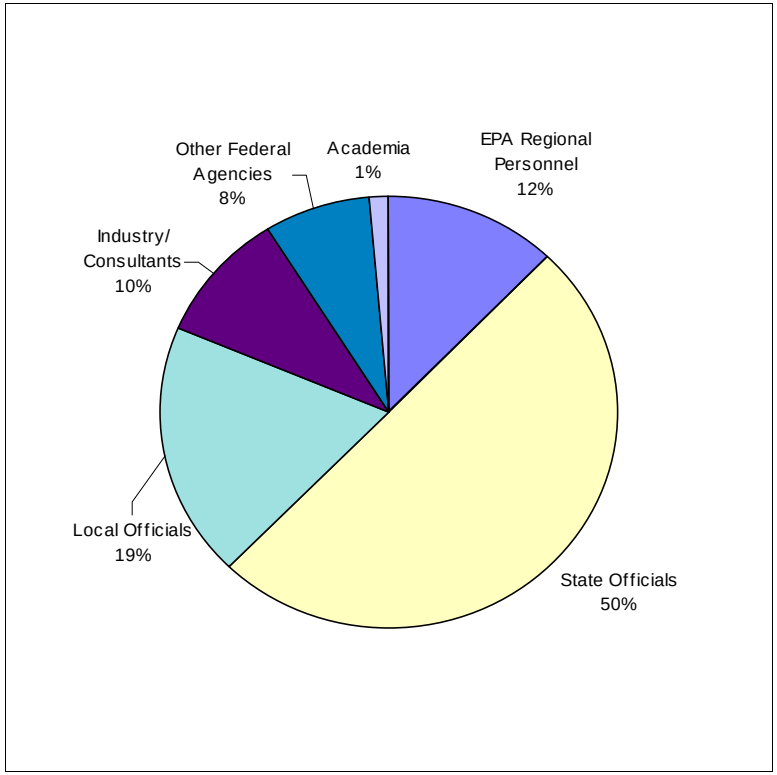
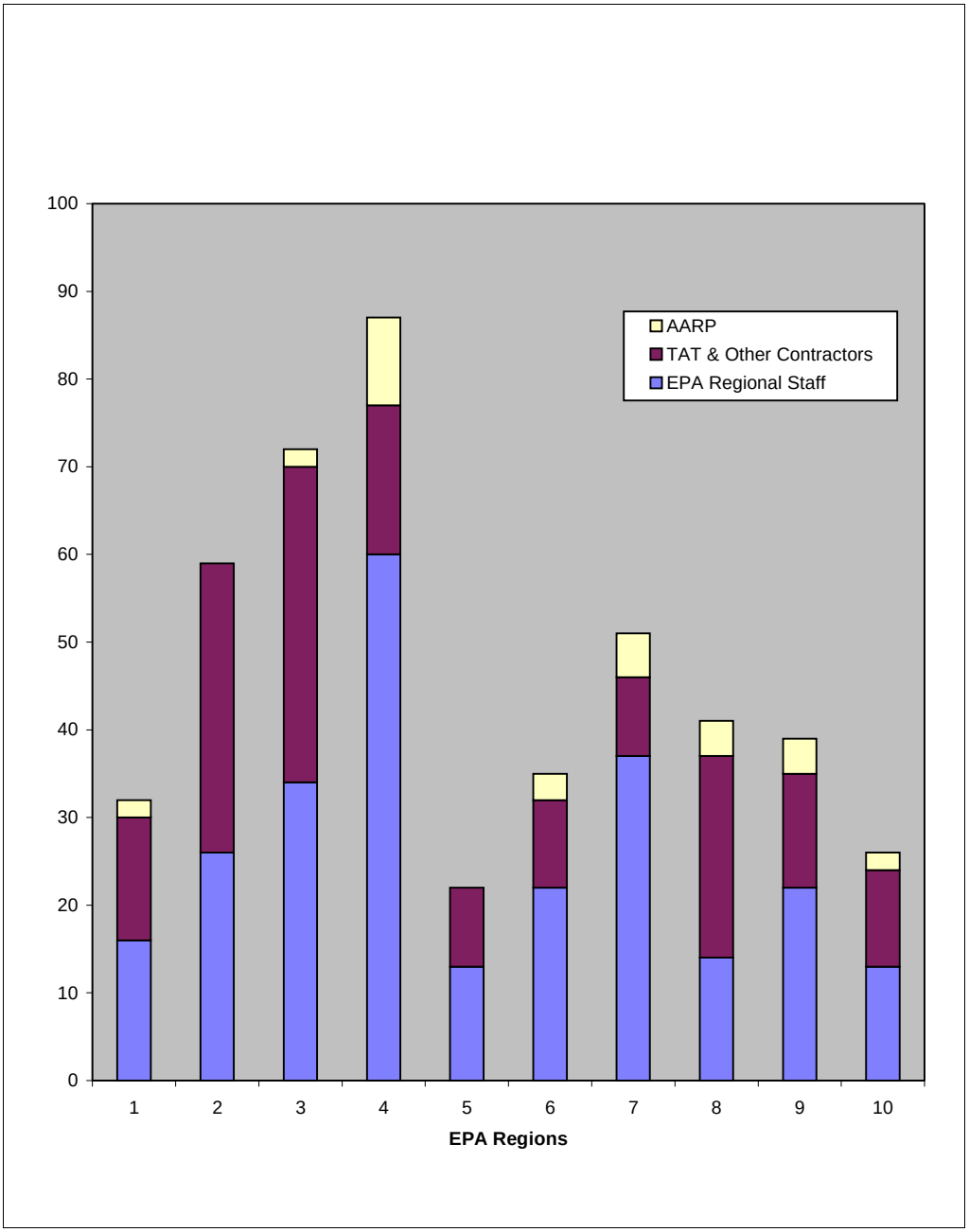


**Exhibit 7**

# Chemical Safety Audit Workshops: Number of EPA Regional Persons Trained

**FY 89 through FY 99**



## 3.0 OVERVIEW OF CSA REPORT FINDINGS

This chapter presents a review of conclusions and recommendations taken from recent EPA chemical safety audits, based on the latest 10 final CSA reports received by EPA headquarters as of September 30, 1999. The results are organized according to the generally recognized elements of chemical process safety management practices, which form the basis for the risk management program regulations issued under CAA section 112(r) (see 40 CFR part 68), and OSHA's Process Safety Management (PSM) Standard (29 CFR 1910.119). These principles are specifically applicable to facilities with complex operations and chemical-based hazards, and, thus, in their detail may not be appropriate for simpler operations that do not involve chemical processing.

These chemical process safety elements are closely related to those of the CSA protocol (Appendix A). The following 16 chemical process safety elements are examined in this chapter:

- Corporate and facility management
- Process hazard analysis (hazard evaluation)
- Offsite consequence analysis
- Process safety information
- Standard operating procedures
- Equipment and instrument maintenance
- Training
- Safety audits
- Accident investigation
- Management of change
- Hot Work Permits
- Contractors
- Employee participation
- Release prevention and mitigation measures
- Facility emergency preparedness and response
- Community emergency response coordination

Each section of this chapter begins with an italicized overview of the key components of the corresponding chemical process safety management element and a discussion of facility practices

described in the latest chemical safety audit reports. CSA report conclusions highlight chemical process safety practices observed at the facility; they reflect the audit team's perception of the facility's understanding of and commitment to chemical process safety management, but are not judgments of adequacy or inadequacy of the practices observed by the team. CSA report recommendations address options that the facility may consider implementing to enhance facility knowledge of and practices in chemical process safety management. These recommendations are based solely on areas observed during the audit and are not required or mandatory actions to be taken by the facility, although audit teams do examine facility practices that are directly related to the components of existing federal regulatory programs (e.g., emergency response plans).

### 3.1 Corporate and Facility Management

*Corporate and facility management play an integral role in ensuring a coherent and consistent approach to chemical safety and health issues at a facility. Corporate management has the unique role of fostering communication among and providing guidance to operations within the corporation, while facility management is better suited for addressing site-specific issues. The degree of support and resources dedicated by corporate and facility management has a direct impact on the effectiveness of all aspects of chemical process safety programs. Identification of responsible personnel is also a key step for ensuring effective process safety management.*

Corporate management plays an important role is supporting process safety management. It can include providing guidance and financial support, establishing standards for equipment and construction, identifying applicable codes and standards, identifying and disseminating hazard information pertaining to chemical and physical hazards at facilities, and participating in or reviewing facility program audits and periodic status/progress reports. Additionally, the majority of the chemical manufacturing facilities are members of the Chemical Manufacturers Association (CMA) and have an active Responsible Care program. In addition, some of the audited facilities have personnel who are active in the LEPC. Finally, some of the facilities are ISO 9000 certified, and facility processes are subject to the OSHA Process Safety Management Program (PSM) Standard.

The majority of the audited facilities' corporate offices provide guidance tools, usually manuals that include required safety procedures, general policies and procedures. One chemical manufacturing facility's corporate management provides a manual that has 13 elements of accountability that facilities are expected to satisfy. Another facility's corporate office prepared an OSHA PSM manual for use at all locations. The manual has in turn been customized by each site to meet its specific requirements.

Another major role that corporate management will play is in-house audits. Almost all of the facilities conducted internal audits. One chemical manufacturing facility conducted a combined "Responsible Care Environmental, Health, Safety, and Transportation (EHS&T)" audit that covered all site functions. Another chemical manufacturing facility reviewed hazard communication, respiratory protection, process safety management, permit required procedure policies, pollution prevention policies, and incident reporting policies. The majority of companies conduct in-house audits every two or three years.

Moreover, facilities ensure that a single individual is responsible for ensuring effective process safety management. For instance, at a chemical manufacturing facility, the plant manager is ultimately responsible for all local safety, health, and environmental matters. Responsible Care is delegated to the Responsible Care Manager. Within Responsible Care, safety, shift coordination, and security issues have

been delegated to the physician and industrial hygienist, respectively; and environmental matters are delegated to the environmental specialist. The Responsible Care manager also serves as the OSHA process safety coordinator.

### 3.2 Process Hazard Analysis

*Process hazard analysis (PHA), also known as hazard evaluation, is a key factor in the prevention of chemical accidents and, generally, in the management of safety at a facility. A process hazard analysis identifies the hazards at the facility, helps assess the risk posed by the hazards, evaluates the consequences of the hazards, and identifies ways in which the hazards can be controlled or mitigated, thus directing facility attention to areas in most need of improvement. In conjunction with the management of change, this analysis serves as a foundation for the ongoing revision of a facility's accident prevention efforts. Although there are several methods for performing this analysis, each approach will provide the facility with information on identifying potential accidental release scenarios and, thus, support the preparation of an offsite consequence analysis.*

For more complex chemical processing operations, facilities conducting a process hazard analysis should use one of the generally recognized formal techniques (e.g., What If, Checklist, Hazard and Operability study (HAZOP), Fault Tree Analysis, or Failure Mode and Effect Analysis); less formal approaches may be sufficient for simpler operations. Depending upon the complexity of the process(es) being examined, facilities may find that a review of the hazards posed by a process, rather than a detailed PHA, may be sufficient to carry out the aim of effective process safety management. Facilities should implement the results of the analysis; this process should be tracked to determine whether recommendations are implemented in a timely manner. Finally, the evaluation should be updated periodically or whenever a process modification is introduced.

Although most facilities have at least an informal program to evaluate hazards, a number of audited facilities have formal hazard analysis programs that are designed to enhance process safety management and identify areas for improvement in facility practices. The audited facilities, for the most part, had a range of 10 to 40 processes requiring PHAs to satisfy the OSHA PSM requirement. In addition to the “What If” and the “Checklist”, many audited facilities use the HAZOP methodology for evaluating hazards in their processing operations.

For instance, one manufacturing facility conducted 40 PHAs that are now in the revalidation stage. Of the 40 processes, 32 are required by OSHA PSM requirements. The additional eight PHAs were conducted either because of corporate requirements or at the option of the site. In addition to “full blown” HAZOPs, mini-HAZOPs are used for evaluating changes and for less demanding analyses. Where applicable, RMP requirements are being considered in the re-validations. Another manufacturing facility has conducted 14 PHAs, two of which have been revalidated. The first PHA was conducted by an outside consultant and the rest have been done in-house. The facility uses computers with purchased software to facilitate the process.

In some cases, the audit teams noted that PHA programs at facilities were incomplete or needed room for improvement. For example, after a review of the tracking procedures at an audited chemical manufacturing facility, it was recommended that the facility consider establishing a deadline, such as every two years, to complete and close out PHA recommendations. At a refinery facility, the audit team concluded that the documentation tracking the status of the PHAs was difficult to follow. The audit team recommended that the facility evaluate and, if necessary, revise the documentation and tracking

procedures for the PHAs.

### 3.3 Offsite Consequence Analysis

*An offsite consequence analysis is designed to assess the potential impacts of a release of a hazardous chemical on the populations and environments surrounding a facility. Based on the potential hazards identified in the process hazard analysis, facilities should examine a range of potential accidental release scenarios to identify the potential offsite consequences and evaluate the likelihood of the release occurring. As a result, the offsite consequence analysis will help facilities establish emergency response needs and priorities in the case of a release (and the implementation of measures to prevent or mitigate such events) based on both their potential impact and their likelihood of occurrence.*

As was the case in last years audit report findings, only a few audit teams found that facilities were using offsite consequence analysis to evaluate potential hazards. As part of the offsite consequence analysis, some of the audited facilities conducted air quality modeling to assess the potential consequences in the event of a leak, spill or fire. One chemical manufacturing facility uses SAFER computer software and an offsite meteorological station for real time modeling of air releases. In addition, the facility uses FAST and TRA programs. Another food processing facility uses SLAB system for air quality modeling to assess its Worst Case Scenario (WCS). Some of the audited facilities do not use modeling but will rely on the EPA "look-up" tables and Emergency Response Planning Guide-2 for predicting modeled endpoint concentrations. In some of these facilities, the WCS has been identified. It was recommended that for that a particular manufacturing facility monitor air releases to verify the air dispersion models.

Another area is identifying the vulnerable areas and populations near the facility. Facilities identified the vulnerable zone, which is an area in which the airborne concentration of a chemical involved in an accidental release could reach the level of concern (LOC). The LOC is generally considered to one-tenth of the level considered to NIOSH's immediately dangerous to life and health. The majority of audited facilities prepared a Risk Management Plan (RMP) in response to EPA requirements to evaluate the effects of chemical releases from industrial facilities. The RMP calculates distances at which a release from the plant would produce atmospheric concentrations greater than the LOC. One manufacturing facility went a step further than developing an RMP where the facility formed a Community Advisory Panel to improve communications between the facility and community. The facility computer program predicts paths and concentrations of chemical released into the atmosphere. If a release could potentially affect the surrounding area, the community warning system is activated. Information on actions to be taken if the warning siren sounds is printed in community calendars that the facility distributes annually. Another audited facility that has not used air modeling to identify vulnerable zones, plans to incorporate air modeling programs to predict and plot plumes for potential hazardous vapor releases at the facility.

For the most part, the audited facilities have identified special/sensitive populations and environments in the vicinity of the facility. For example, an audited food processing facility has identified nine threatened or endangered species and twelve sensitive populations in close proximity to the facility. The corporate and facility personnel utilized an air release model, Slab View, and provided the audit team with a worst-case Toxic Release Zone of Influence model maps based on a catastrophic failure of its ammonia receiver. One map utilized USGS, another depicts Street Map USA, and a third model depicts Land View III. Each map (using the same worst case conditions) models the plume for a simulated ammonia release, which covers a 1.99 mile radius. Some of the recommendations included a

more formal process for assessing offsite consequence analysis.

### 3.4 Process Safety Information

*Documentation of process safety information (including chemical hazards and process technologies and equipment) is important because a facility's accident prevention program must be based on up-to-date information on chemical hazards, processes and equipment.. Data on chemical hazards ensure that a facility's employees understand the inherent toxicity of a substance, as well as the potential for fire, explosion, corrosivity, or reactions with other chemicals. Current data on processes are imperative to conduct a hazard evaluation and to implement effective standard operating procedures, training, and maintenance. Equipment information-piping and instrument diagrams, materials of construction, electrical classification, relief system design and design basis, ventilation system design, design codes and standards employed, material and energy balances, and safety systems - should be documented and kept current.*

In many of the audited facilities, audit teams made specific mention of and commended facilities that made Material Safety Data Sheet (MSDS) information readily available and understandable to employees. Audit teams noted that facilities maintain electronic versions of MSDSs of different chemicals in the facility. Among the facilities audited this year, a significant number of the facilities maintained computerized copies of MSDS information. For example, at a large chemical manufacturing facility, MSDSs are available to the employees for all of the materials on-site. For the raw materials that are not facility manufactured, in-house MSDS bulletins were developed because the information for some materials may differ from supplier to supplier. All MSDSs and MSDS bulletins are accessible through the facility's CD-ROM program on all company computers, at stand-alone computer stations, and from hard copies which are located in managers and supervisors offices. One refinery has made MSDSs available throughout the facility via computers on the local area network (LAN) and in addition, hard copies are maintained by the Safety and Compliance Coordinator.

In some cases, audits also revealed facilities whose chemical hazards were not formally identified or were poorly documented. At a one nitrogen facility, the documentation provided to the audit teams did not include action levels of respiratory protection utilized at the facility in situations other than emergency situations. The facility is in the process of reviewing the monitoring equipment available to personnel and is currently developing "hard triggers" for concentration requiring respiratory protection. The audit team recommended that the concentrations requiring levels of respiratory protection be specified in the appropriate operating procedures and/or reference documents or policies.

### 3.5 Standard Operating Procedures

*Standard operating procedures (SOPs) provide the basis for coherent, safe facility operations by supporting safety in day-to-day activities and in operator training programs. SOPs describe site access, process startups and shutdowns during routine and emergency operations, lockout and tagout, confined space entry, opening process equipment or piping, storage, handling, loading, and unloading. SOPs addressing operating parameters should include operating instructions about pressure limits, temperature ranges, flow rates, and steps on how to handle process deviations. Furthermore, SOPs should be reviewed as necessary to ensure that they reflect current operating practices (including changes that result from alterations in process chemicals, technology, equipment, and modifications of the facility) and that current information is transmitted as part of employee training.*

Many of the audited facilities prepared, revised, reviewed, and approved SOPs in accordance with OSHA Process Safety Management (PSM) requirements. A number of the audit teams noted that the SOPs are written by operators or process engineers and approved by the unit supervisor. A cursory review of the SOP writing procedures of one facility, a producer of chemical intermediates, noted that while the SOPs included all the necessary operating steps, they may not reference all the SOP elements specified in the PSM standards.

Audit teams cited several examples of how SOPs are updated and in what form (hard copy, electronic format) they are used. One such facility, a specialty chemical manufacturer for the microelectronics and water treatment industries, prints a valid-until date on all copies of the SOPs printed from the local area network (LAN). The facility therefore allows for the appropriate use of temporary SOPs without confusion over the end date. Another facility, a producer of chemical intermediates, thoroughly reviews SOPs annually, and updating and reissuing them as necessary. The audit team noted that the electronic copy is often used for operating purposes and could conceivably be out of date for short periods. Another facility, a manufacturer of polydimethylsiloxanes, considers only the hard copy as "controlled" for operating procedures. Temporary handwritten changes are often made to the hard copy until a formal review is completed. The hard copy is then photocopied for technicians who need a copy of a particular procedure. The reverse is true at a facility that produces powder Ibuprofen. This facility maintains the controlled copies electronically and hard copies are printed when needed. The audit team also noted that this facility has separate manuals describing the processes and "logbooks" or batch sheets that detail operating steps. A different logbook is often used for each process of a given batch. The logbooks also identify those personnel qualified to conduct the specified operations.

At one fuel additive and lubricant production facility, an audit team noted an integrated training and documentation system that contains the SOPs and other documentation for nearly all plant functions. At another facility, an active refinery, the audit team noted that special "training supervisors" train all operators when changes occur and then sign off on the management-of-change documents. At another facility, a formaldehyde and resin producer, the audit team recommended further documentation integrating temporary procedures and approved changes into the management of change procedure.

### 3.6 Equipment and Instrument Maintenance

*Equipment and instrument maintenance falls into two categories: predictive/preventive maintenance, which is performed to avoid equipment failure or breakdown, and emergency maintenance, which is performed in response to equipment failure. While emergency maintenance is an essential element of any facility safety program, systems of predictive or preventive maintenance are essential to the prevention of equipment failure and subsequent releases. The purpose of a maintenance program is to ensure that equipment is regularly monitored and serviced so that emergency situations do not occur; this can help not only to prevent releases, but also to decrease facility downtime and increase overall efficiency. To be effective, maintenance programs should cover chemical process and handling equipment, instruments, and emergency response equipment.*

Most of the audited facilities use a computerized work order system to run their preventive maintenance programs. A number of these facilities use the sampling and analysis plan (SAP) computerized work scheduling module. One facility, specializing in the production of performance chemicals ( i.e., for the microelectronics and water treatment industries), generates work orders through the "SAP" computer system. The work orders are then assigned a priority level based on the potential for

environmental release or health hazard. The maintenance crew must complete the work order within a specified time based on the priority level. Most of the audited facilities used their computerized work order system to generate automated maintenance schedules. Most of the audited facilities appeared to have at least adequate preventive maintenance measures in place and those without a computerized system had the plans to implement one. At a resin production facility, an audit team noted that the facility was manually entering completed work orders into a computer database for future use with the SAP module.

The facilities appeared to follow two general models for their maintenance crews. One example is a manufacturer of polydimethylsiloxanes whose employees work plant wide and are divided into operating groups according to their associated skills and training. The other model divides the maintenance employees into operating areas. For example, at one of the nation's largest producers of powdered Ibuprofen, the maintenance groups are assigned to a specific areas of the facility.

Many facilities, such as a chemical intermediates production facility, use a system that allows any employee to generate work orders, but each request must be approved by a supervisor. At the majority of the facilities, the maintenance crews work the day shift, but are often on call in case of an emergency. A few facilities also supplement their full time staff with contractors on a regular basis.

At one facility, a beef slaughter operation, the Audit team recommended including sensor calibration/testing in the preventive maintenance program to ensure the proper maintenance and calibration of sensors. This facility was expected to receive a computerized maintenance management system that will hold maintenance and mechanical integrity information all the system components and automatically issue preventive maintenance work orders as scheduled.

### 3.7 Training

*Training of supervisory and operations personnel provides the most immediate opportunity to increase awareness of chemical health and safety issues and ensures the competence of employees in performing their responsibilities. Training programs are the key to ensuring the effectiveness of SOPs, maintenance programs, pre-startup reviews, and emergency response. Refresher training ensures that established employees are reminded of appropriate procedures periodically and of alterations that have occurred. To minimize the risk of accidents occurring because employees are unfamiliar with their assigned tasks, a successful training program for a facility with complex, chemical processing operations should include the following: initial and refresher training for all employees; procedures to confirm that all employees are competent to do their jobs safely; additional training after any change is made to the process or to the facility overall; and formal documentation. Smaller operations, and those with more limited chemical handling activities, may find a less formal program sufficient to fill their health and safety needs.*

All the facilities audited had at least some form of new employee orientation for regulatory and safety training ranging from a couple of days to a couple of weeks. In addition, most of the audited facilities used on-the-job training for new employees to begin learning skills from experienced operators. The majority of new employees are somewhat restricted until they have passed the necessary training programs. For example, at a chemical intermediates facility, all operators must pass a written and hands-on demonstration test before being qualified to operate independently. The facility documents all employee training in the Occupational Training Information System (OTIS). The audit team also noted that an increase in routine training has raised employee awareness to the possible hazards associated with

the chemicals they handle.

A number of facilities have a classification system for their operators that is based on both experience and training. For example, a powdered Ibuprofen producer has specific training requirements for each of four operator levels. Operators train for skills demonstrations and written tests by using simulators, studying manuals, and using interactive videos. At both this facility and a polydimethylsiloxanes producer, audit teams noted that Human Resources maintained training records of all employees in electronic and hard copy form.

One facility, specializing in the production of performance chemicals ( e.g., for the microelectronics and water treatment industries), supplements the on-the-job training with classroom work and requires monthly regulatory training for all employees. The facility also provides refresher training in a chosen certification at least every three years. Another facility, an ammonia and nitrogen production facility, has three levels of training beyond orientation; basic training, job-specific training, and refresher training. The facility requires that each employee must show competency in the training by passing a written and/or performance based test.

An audit team at a beef slaughter operation suggested that security personnel receive comprehensive training outlining their expected role in a chemical emergency. At a refinery facility, the audit recommended that the facility explore options to expand their wellness program. A film producing plant was noted to encourage employee wellness and provided an excellent on-site health center.

### 3.8 Safety Audits

*A schedule of regular audits not only improves specific process unit conditions, but also supports a consistent approach to health and safety issues throughout the facility. The safety audit has two purposes. First, it serves as a tool for management to ensure that covered processes are in compliance with the chemical accident prevention regulations, as well as other environmental regulations. In addition, the audit allows management to perform a "real-time" check on the safety of its operations. A safety audit should include at least one person knowledgeable in the process, a written report with recommendations, and a management response. The size of the safety audit team, and the formality of the follow-up process, can be scaled to suit the complexity of the process being audited. To be effective, management should document actions taken to address and correct deficiencies identified in the report.*

Several of the audited facilities conducted safety audits, both internal (i.e., conducted by facility personnel) and external (i.e., conducted by other individuals). For instance, one chemical manufacturing facility conducts several audits, as well as participating in outside inspections and audits by consultants and regulators. The audit reports are tracked and the safety manager ensures that the documentation pertaining to the audit, findings and recommendations are maintained and followed-up on. In addition to internal “spot” audits conducted by the facility and audits conducted jointly with environmental managers from other company facilities, the State Environmental Department performs environmental audits every year, and the local Fire Department also tours and inspects the facility annually. At another facility, corporate management conducts a general health, safety and environmental audit of the site every 2 years and the mandatory OSHA PSM audit every 3 years.

The frequency of safety audits varied among the audited facilities. While, some of the facilities scheduled monthly safety and housekeeping audits, in other cases these audits were conducted less frequently, from quarterly to annually . The level of resources and attention that was devoted to safety

audits also varied substantially among the facilities. In some of the facilities, the auditing programs have been specifically demarcated. For example, at a chemical facility, there are two formalized auditing programs: a "Management/Supervisor Team Audit" and the Plant Manager's Safety and Housekeeping Inspection." The Management/Supervisor Team Audit is conducted by a team manager as team leader with three supervisors as team members. In addition, the facility uses a behaviourial based employee safety audit process (B-safe) to observe and improve safe work practices. In contrast, audit teams at a refinery noted that other than safety equipment and preventive maintenance inspections, routine formalized audits are not generally conducted by site personnel. The Safety and Health Committee conducts an inspection approximately quarterly, and the facility loss prevention insurance carrier usually conducts an annual inspection.

### 3.9 Accident Investigation

*Facilities should investigate releases to identify the root causes of accidents to prevent repeated or similar accidents and to assess the need for improvements in equipment, maintenance, training, and operating procedures. The concept of root cause involves identifying management system inadequacies or failures, such as poor design or lack of training, that allow leaks to occur, when, for example, an operator turns the wrong valve in a process line. To address the root cause would be to design a fail-safe process, or make operators more aware of proper procedures, rather than focusing on the initiating cause and assigning blame.*

*There are four generally recognized components of a comprehensive accident investigation program. First, the facility should establish procedures to investigate accidental releases or near misses and develop a system to promptly address and resolve accident report findings and recommendations. When a release occurs, the facility should promptly initiate an investigation by a formal accident investigation team to find the facts and root causes of the incident. Next, the team should prepare a summary investigation report that includes key data about the incident and any recommendations for remedying the root cause(s). Finally, the facility should document any resolutions and corrective actions taken and review the accident report with personnel whose job tasks are relevant to the investigation's findings.*

All the audited facilities maintained a historical record of accidental releases and incidents; however, many of the facilities only maintained records of severe spills or spills or releases that qualified as a NRC reportable release. For instance, at one chemical facility located in Kentucky, the OSHA recordable incident rate of 2.73 in 1998 was much below the average OSHA recordable rate for chemical manufacturing industries in the Commonwealth of Kentucky which was 3.9 in 1998. According to the facility calculations only one of the chemical spills at the facility qualified as a NRC reportable release during 1998. With the exception of a couple of facilities, the remaining audited facilities had OSHA reportable rates that were lower than the average OSHA reportable rates for facilities in their respective states.

The majority of the audited facilities had implemented explicit accident investigation procedures requiring follow-up reports or actions. Facilities had different procedures for identifying the underlying causes of accidents and unplanned incidents. Many of the facilities have adopted computerized databases and software programs to track and manage their accident investigation efforts. For example, one chemical facility manages its accident investigation process through the facility Intranet and Incident Record Tracking System (IRTS). Not all incidents reports to the IRTS are investigated; the area manager and the safety superintendent together decide if a formal investigation is necessary. All open incidents on

the IRTS are reviewed monthly by plant management during monthly operating review meetings, and upon completion of the investigation, the area supervisor provides the investigation report to the affected employees and contractors working in the area of the incident. Another facility, a refinery, had recently installed "AccuSafe Pro" a software program that helps the safety department manage the incident reporting and investigation system more efficiently. Audit teams at one chemical facility noted that the facility had implemented a causal-tree investigation procedure. The program is designed to investigate any incident that resulted in, or could result in, injury, death, chemical release, fire, or explosion.

In some cases, audit teams made specific recommendations encouraging facilities to develop more complete accident investigation programs and follow-up procedures. The audit team at a refinery urged the facility managers to develop the following in the incident investigation procedures: a ranking system to prioritize investigations, specific time frames to complete incident investigations, record minutes of each investigation meeting, and follow-up audits for all reportable incidents and spills. Similarly, the audit team at another chemical facility also stressed the need to develop specific time frames within which to complete the accident investigation and follow-up initiatives.

### 3.10 Management of Change

*Chemical processes are integrated systems; changes in one part of the process can have unintended effects in other parts of the system. For example, installation of better seals may increase the pressure in vessels, and thus, the opportunity for excess pressure situations to develop. It is, therefore, important that all changes in processes, chemicals, and procedures be reviewed prior to their implementation to identify any potential hazards that may be created by the modification. Chemical processing facilities should develop written procedures to review and manage changes in processes, chemicals and procedures prior to their implementation. A facility should identify potential hazards that may be created by such changes and ensure that facility procedures, process safety information, training, and process hazards analysis reflect changes and are kept up-to-date. At smaller facilities with less complex chemicals operations, however, such a thorough, formal approach may not be necessary.*

Most of the facilities had well documented Management of Change (MOC) procedures. In a number of the facilities, audit teams noted that MOC procedures are followed to ensure that only replacement-in-kind repairs are completed without proper authorization. Most of the facilities used preventive maintenance and inspections where possible and for satisfying PSM mechanical integrity requirements.

In some cases, audit teams noted explicit and formal MOC procedures. For instance, at one facility, instrument upgrades or change requests can be originated from operations, engineering and maintenance. A technical change request is approved by operations, maintenance, safety and environmental personnel, then the change is evaluated using the MOC process. After the requests are prioritized, the schedule for completion is set up based on the priority of the project. Instrumentation change requests can be generated as a result of HAZOP, incident investigation or audit; however, the MOC process, including training needs to be completed prior to new instrumentation being used. In other cases the MOC procedures were found to not be as rigorous. For example, one chemical facility uses a computerized work order system. Any employee is authorized to submit a work request, but these requests must be authorized by an operating supervisor. The work authorization request is reviewed by operations for MOC considerations. However, the audit team at this facility found that the submitted authorization form lacked adequate documentation that this has been done.

For FY99, audit teams did not suggest specific improvements to MOC programs at these facilities.

### 3.11 Hot Work Permits

*Non-routine work that is conducted in process areas needs to be controlled by the facility in a consistent manner. The relevant hazards should be communicated to those doing the work as well as those operating personnel whose work could be affected. A system of "hot work permits" protects employees and others from potentially hazardous situations resulting from non-routine, "hot work" operations (e.g., welding) that may take place in process areas. Hot work permits should document that the required fire prevention and protection measures have been implemented and should indicate the date(s) authorized for hot work and the object on which the hot work is to be performed.*

The majority of the audited facilities have hot work permits or similar procedures in place to protect employees from hazardous exposures/situations. In some instances, audit teams noted that written permits are required before any hazardous maintenance work is performed. For example, at a chemical facility special permits are required before doing hot work, excavation, confined space entry, fire protection water system modifications, asbestos removal, lead-based paint removal, high altitude work, and exhaust system modifications. In other facilities, hot work and confined space permits were used more selectively. For example, at a refinery a lock-and tag-out procedures and hot work permits are used where there is a potential for high energy release.

Audit teams did not make any specific suggestions regarding improvements in facilities' hot work permit systems.

### 3.12 Employee Participation

*An important component of a successful process safety management program is active and informed participation by employees. Employees have uniquely informed perspectives on facility processes and situations. Accordingly, employers need to consult with their employees as they develop and implement a process safety management program and hazard assessments. Ideally, safety information should flow both from the employer (e.g., training and education for employees, informing affected employees of the findings from incident investigations, and publicizing company-wide initiatives) and from the employee (e.g., through participation in safety committees, use of anonymous comment boxes, and through membership on safety investigation teams).*

Many of the facilities appeared to have programs in place to encourage employee participation in safety issues. In some specific cases, audit teams noted that facilities had programs providing incentives to employees for participation in safety management. For instance, at a chemical facility, the Plant Performance Incentive Plan is an annual monetary award based on points earned in four areas, including responsible care and process safety management. Monthly milestones are set for standard operating procedure (SOP) reviews and completing work orders. Additional points are earned for exceeding milestones. The potential payout to individuals is $1000 if the facility meets the zero criteria on reportable releases, incidents, and satisfies criteria for PSM, transactions, and budget performance. At another facility, each employee is encouraged to develop and successfully execute an Individual Safety Action Plan. The facility rewards employees when the facility completes calender quarters without having OSHA recordable incidents.

Audit teams found that most of the facilities held regular safety meetings to promote employee

participation. One facility has a Central Safety Committee that meets monthly to address safety issues and to participate in walk through safety and housekeeping inspections. The committee is made up of wage-roll personnel from all plant areas and by the Plant Manager, Superintendent of Safety and Security, and a management representative from both operations and maintenance. Another refinery conducts weekly "Tool Box" meetings for maintenance employees. Safety meetings for production employees are conducted less periodically and involve self-directed safety training.

### 3.13 Contractors

*Facilities that use contractors to perform work in and around processes that involve hazardous chemicals need to include their contractors in the facility process safety management chain. Special efforts must be made to screen contractors appropriately and to assure that contractor employees receive up-to-date training and emergency procedures information. The following activities should be conducted, as appropriate: informing contractors of potential fire, explosion, or toxic release hazards; explaining to contractors the applicable provisions of the facility emergency plan; developing work practices to control the entrance, presence, and exit of contractors in process areas; providing and documenting contract employee training; and evaluating the performance of contractors in fulfilling their obligations.*

In a few of the facilities audited this year, audit teams specifically noted the role of outside consultants/contractors. In each of these instances the facilities took extra precautions to ensure that contractors were well-informed and trained on facility process safety. For instance, the audit team at a food processing facility observed that the facility has a written policy and procedures for contractor hazard communication, training, and documentation for contractors performing work at the facility. The procedures include a pre-bid five page written contractor qualifications and reference questionnaire, and a contractor awareness program. The awareness program includes a review of the chemicals and hazards encountered at the facility, block diagrams of the ammonia system, and a review of the facility safe work practice and permit programs and the facility emergency plan.

Another chemical facility engaged a staff nurse to be present during normal working hours to address the problem of providing medical attention to the large number of contractors on site. The facility has determined that the current contractor safety incident rate is unacceptable. A combined employee and contractor site OSHA recordable incident rate goal of 0.15 has been established for 2000 and 0 for 2001.

### 3.14 Release Prevention and Mitigation Measures

*Release prevention and mitigation measures are the practices and equipment implemented by a facility to address the potential for accidental releases of hazardous chemicals. Because each operation is unique, they are by nature site-specific. Prevention systems seek to reduce the likelihood, or severity, of accidental releases of hazardous chemicals. Examples include monitors, detectors, sensors, and alarms for early detection of accidental releases, and backup equipment and redundancy features to protect against sudden accidents or failures. Containment structures, flares, scrubbers, quench systems, and surge or dump tanks, can also act to prevent an abnormal occurrence (e.g., overpressurization) from producing a release. Substitution of hazardous chemicals with less hazardous substances, inventory reduction, and other process design changes can lessen the potential for accidental releases of hazardous chemicals. Finally, practices that may reduce the severity of the impact of a hazardous chemical release (e.g., by containing its spread and neutralizing volatility) can be grouped together as release mitigation systems.*

Facilities have implemented technological and procedural solutions to increase their ability to detect and prevent releases. Several of the facilities have accident prevention programs in place in accordance with OSHA PSM requirements. In addition, many of the facilities have undertaken steps to reduce the hazardous and toxic chemicals they use on site that could be involved in a release event. Audit teams also found that a number of technological systems have been put in place and a variety of release prevention measures have been implemented by facilities.

Many of the facilities have secondary containment systems and high- level alarms on process and storage tanks and vessels. For example, at one refinery process control valves are designed for fail safe operations. All storage tanks have secondary containment. In addition the facility has a formal leak detection and repair program, and leaking vessels are repaired or replaced on a as needed basis. At another chemical facility, all process tanks are diked, and most tanks have high level alarms with automatic shutoffs. One facility was found to have established an equipment reliability group from among the personnel and also developed a mechanical inspection program. Processes within the facility are designed with redundant controls, interlocks and emergency shutdown systems. Several of the facilities have also installed emergency generators and uninterrupted power supply systems for their major processes and to provide electric power for a safe shutdown in the event of a power outage.

In most of the audited facilities the major site hazard is fire. Audit teams found that most of the facilities had installed fire extinguishers, fire monitors, and sprinkler systems in vulnerable areas within the facility. For instance, one facility has installed a fire water system that supplies water to fire hydrants, monitor guns or canons, sprinklers and the deluge system. In addition, the facility has a Halon suppression system, three foam systems, and a carbon dioxide system. The facility has over 1000 portable fire extinguishers, two water pumpers and a rescue/medical response truck.

In a few specific cases, audit teams noted that there was room for improvement in the release prevention and mitigation measures. At one food manufacturing facility, audit teams noted that mitigation systems were not clear in documentation provided to the audit team for review. The only mitigation system observed by the audit team during the on-site inspection was the ability to isolate virtually any portion of the ammonia refrigeration system should a problem occur. The audit team recommended that sensor calibration/testing be included in the preventive maintenance program to ensure timely maintenance and calibration schedules. At another film processing facility, the audit team suggested that the facility should consider using secondary containment for any spills that may occur during the refueling operations at the facility fuel pump. Audit teams at a refinery recommended that the facility should construct containment systems to prevent the leaked product from entering the sewers. The audit team also noted that secondary containment was missing for the cooling water chemicals.

### 3.15 Facility Emergency Preparedness and Response

*Comprehensive facility emergency planning is a crucial element in effective and rapid response to accidents. An emergency response program prepares a facility to respond to and mitigate accidental releases, thereby limiting the severity of such releases and their impact on public health and the environment. Generally accepted practices with regard to emergency response programs can be grouped into five activities: developing an emergency response plan; training employees in relevant emergency procedures; acquiring equipment to support response efforts; conducting drills and exercises to test the plan and evaluate its effectiveness; and coordinating with the surrounding community. The first four of these activities are dealt with in this section; coordination with the community, a focus of the Emergency Planning and Community Right-to-Know Act (EPCRA), is discussed in the following section. Although*

*there is a common understanding of these key components of an emergency response program, emergency preparedness and response activities nonetheless can vary significantly for facilities of varying size and complexity. Facilities that are small, or where the likelihood of a release is minimal, may choose not to (or be unable to) respond to an incident with their own employees. Such a facility might choose to maintain evacuation procedures and procedures to contact outside parties (e.g., local response agencies, contractors), rather than developing extensive emergency response plans.*

Emergency Response Plan

*A facility's emergency response plan is a critical element in the auditing process because, in many respects, the plan reflects a cross-cutting set of facility activities and procedures. The plan also demonstrates the facility's commitment to minimizing harm to its own employees and the surrounding community if an emergency situation occurs. During an audit, the team reviews the organization of a facility's emergency response plan, its utility in the potential emergencies that a facility may experience, and its comprehensiveness. An emergency response plan should be comprehensive in two senses: plan elements are addressed in a site-specific, rather than generic fashion, and the plan contains all the critical elements necessary to a successful response effort.*

Audit teams found that most of the facilities had well developed emergency plans. In several cases, audit teams noted that facilities requirements specify that the emergency plans and safety manuals need to be revised and reviewed, and in some cases updated annually. For instance, at one chemical facility, the responsibility for the review and update is divided between different facility personnel and the responsibility for each emergency management section is documented in the safety manual. The Safety and Loss Prevention (S&LP) team leader, with a committee comprised of a site supervisor and a loss prevention technician performs a comprehensive annual review of the manual.

Audit teams noted the presence of multiple emergency plans in some facilities. For example, one chemical facility maintains two Emergency Response Plans (ERPs). The first, titled Plant Protection and Emergency Guidelines (PPEG) manual, summarizes emergency guidelines and is intended for the plant population. All employees receive training based on this guidance. The second, titled Comprehensive Emergency Management and Contingency Plan (CEMCP) Manual, is intended for use by the Plant Emergency Coordination Team and support personnel, and the Emergency Response Teams. In addition, the facility maintains Spill Prevention, Control, and Countermeasures (SPCC) and Oil Pollution (OPA) 90 Facility Response Plans. In some cases multiple plans are included under an overall emergency response plan. For instance, one particular facility’s ERP includes a SPCC plan and a Hazardous Waste Emergency Response Contingency Plan.

In 1996, EPA, in conjunction with the National Response Team, issued the *Integrated Contingency Plan Guidance* to provide a mechanism for facilities to consolidate multiple plans into a single functional emergency plan. This document was intended to increase the functionality of emergency response plans examined in future audits. It is noteworthy that only one of the facilities is in the process of converting its emergency procedures into an Integrated Contingency Plan (ICP). Although the ICP has not been officially instituted at this facility, the audit team reviewed the plan and found it to meet the National Response Team’s ICP guidance.

Although a number of the audited facilities have specific elements in their response plans that are site specific, there are certain standard components that are found in most of the plans. The majority of facilities have evacuation procedures and have marked escape routes on maps posted around the facility.

In most of the cases, evacuation and headcount procedures are clearly defined in the response plans. However, the level of detail and specific procedures differ among the facilities. One facility's emergency response plan includes procedures for conducting both plant-wide and unit or area wide fire evacuations. Detailed maps of the facility and its proximity in the community are included in the emergency plans. Within the facility map, primary and secondary evacuation assembly points are designed. At another chemical facility, plant-wide evacuations are signaled by a continuous blast through the plant siren system. Emergencies involving hydrogen cyanide are indicated by one of several hydrogen cyanide specific alarms. In addition, evacuation procedures specific for hydrogen cyanide emergencies are clearly defined in the Emergency Procedures Manual.

In a few of the audited facilities, the Emergency Release Plans provide details of follow-up release procedures. At one facility, the emergency plan addresses various aspects of post emergency recovery and also has a section on incident critique and follow-up. The plan outlines the responsibilities of different facility personnel and states that the crisis manager is responsible for conducting a critique as soon as practical after the emergency incident. The crisis manager is expected to solicit the views of different personnel while conducting the critique.

However, in some specific cases, audit teams noted that there was room for improvement in the emergency response plans and made recommendations. In some cases, audit teams recommended having a third party review of the Emergency Response Plan/Integrated Contingency Plan before full implementation. In one particular instance, the audit team at a refinery commented that the facility should evaluate adopting the Integrated Contingency Plan. At a food processing facility, in order to simplify emergency procedures, the audit team suggested that the respiratory protection policies and procedures be removed from the emergency plan and listed as a separate policy that is referenced in the emergency plan. The audit team also recommended that the emergency plan at the facility be reviewed following any incident and that exercises be used to detect deficiencies in the plan. Changes to the plan could then be executed consistent with the facility's management of change requirements pertaining to the emergency plan.

Training

*Emergency response training must meet the needs of a facility in addition to complying with all federal requirements; specific training needs may include procedures for spill or vapor containment and fire fighting, or decision-making on the need for response, evacuation, or in-place sheltering. Comprehensive emergency response training programs can cover a wide range of site-specific activities, including evacuation and sheltering procedures, incident command systems, release notification, and fire fighting.*

In most of the facilities, audit teams found that emergency team members are trained in emergency response in accordance with OSHA regulations. However, the degree of commitment to emergency response training varied among the audited facilities. In some cases the training programs were found to be very thorough. For example, one chemical facility uses a tiered system of centrally organized and trained personnel who are available to respond to incidents involving fire and hazardous materials. The Loss Prevention Department at this facility staffs each shift with a minimum of two technicians who are state-certified fire fighters and Emergency Management Trainers. They are also trained to the hazardous materials technician level and receive continuous training in vertical rope and confined space rescue. The fire brigade is trained and equipped to support the Loss Prevention

department. All Basic Area Production Technicians are trained and required to maintain annual certification as hazardous materials technicians. In addition, response team leaders are trained and have a thorough working knowledge of the Incident Command System (ICS) and are trained to the First Responder Operations Level. At another facility, all persons receiving training are evaluated and certified based on skill demonstrations and practical exercises. Emergency respondents undergoing training are certified by the Safety Supervisor and the Safety Manager at the facility.

Audit teams found that a significant number of facilities are taking advantage of offsite training opportunities to allow for a mix of site-specific training and more general response and rescue training in various fields. For instance, at one facility, the training pertaining to chemical emergencies is provided to local fire departments, including mutual aid support and product end users. This facility also schedules training joint training programs with the neighboring facility and utilizes the highway cargo boiler and the rail car available at that facility in its training programs.

In a few cases, the audit teams found that the commitment to emergency response training was inadequate or lacking. At one chemical facility, the audit team strongly recommended that the facility train personnel to the level of emergency medical technician in order to able to attend to injured personnel when a nurse or doctor is not available on site. At another food processing facility, facility personnel indicated to the audit team that security personnel were included in the facility emergency plan. The audit team suggested that the procedures to be followed by security personnel during a facility emergency should be clearly outlined and monitored during facility drills.

Emergency Equipment

*Emergency equipment, ranging from safety gear to response vehicles to communications apparatus, must be available to implement the emergency activities designated in the plan. However, with the exception of OSHA fire prevention regulations, there are no detailed federal requirements on what equipment must be available to respond to a hazardous materials emergency. As a result, each facility must decide which equipment is necessary to address likely accident scenarios and develop a system for maintaining it. In addition, to be effective, response equipment should be staged in areas not likely to be affected by an incident, but close enough to be quickly accessed by response personnel.*

Facilities often need a range of equipment that can include personal protective equipment, SCBA, safety showers, and eye wash stations; absorbents, neutralizing agents, and booms; portable pumps and hoses and fire monitors; response vehicles; and monitoring instruments, as well as backup equipment. Most of the facilities were noted to have a significant amounts of response equipment on site. At a chemical facility, emergency equipment is distributed throughout the site. The facility has several fire extinguishers, fire monitor cannons, 16 sprinkler systems, a 250,000-gallon fire water tank, and two fire water pumps. In addition to fire fighting equipment, the facility has a HAZMAT response trailer equipped with air monitoring equipment and spill response equipment. At another chemical manufacturing facility, the audit team found that the facility has two trucks for general site tours and initial emergency response. The facility also had a suburban-make vehicle to be used as a hazardous material incident support vehicle, and a hazardous materials response truck equipped with personal protective and decontamination equipment.

Several facilities also have extensive emergency communications capabilities. Most facilities have emergency warning and notification systems, including alarms and public address systems. However, few of the facilities had more elaborate communications systems. For instance, at one facility,

in addition to a emergency warning and notification system, the audit team noted that there was a Group Pager System, two way radios using five different frequencies, and telephones and cellular phones. Another chemical facility has installed a three-channel VHF radio system, and a 16-channel UHF radio system with a high power repeater and low power non repeater in addition to a plant-wide alarm system and a regional paging system.

In several of the audited facilities, responsibilities for conducting inspections and maintenance of emergency equipment is clearly delineated. For instance, the procedures at one facility clearly specify that the facility emergency coordinator is responsible for ensuring that inspections are conducted, materials are adequate, and personnel are trained in accordance with written emergency response procedures. All sprinkler and alarm systems are inspected quarterly by a certified local contractor, and the fire pumps are inspected and tested weekly by the utilities operator. At another facility, the Loss Prevention Department is responsible for maintenance and inspection of the equipment.

In one instance, the audit team noted that the responsibility for equipment inspection and maintenance is not clearly defined in the ERP. In a few other cases, audit teams suggested specific areas for improvement with regard to the emergency equipment provisions at facilities. The audit team at one chemical manufacturing facility recommended that the facility should consider installing safety showers per OSHA rules at the aluminum alkyl tank feed location. The audit team also urged the facility to consider installing panic buttons with audible alarms per OSHA rules, in all aluminum alkyl areas having tank connections or the possibility of a release. The audit team at a refinery suggested that the facility should install audible alarms with a tie to the control room at wash stations. The audit team also recommended that the facility install fenceline monitors at the facility plant.

Drills and Exercises

*Drills and exercises supplement training and allow each employee to understand more clearly what steps to take in the event of an emergency. Testing emergency procedures, such as evacuation routes, internal/external alert systems and community coordination, enhances response time and demonstrates whether the procedures are viable in an emergency. Drills and exercises generally cover evacuations, fire fighting, and medical and rescue operations; field response to a hazardous materials event may also be addressed, although generally with somewhat less frequency.*

The majority of the audited facilities conduct drills and exercises, although the frequency and contents of the drills varied among facilities. Several of the facilities conduct annual drills. For instance, the Emergency Assistance Team members conduct annual emergency drills at a chemical manufacturing facility. The drills are conducted to maintain preparedness and regulatory compliance. The management conducts a follow-up evaluation after the drill and writes a written summary. The recommendations related to the drill are required to be completed within a specific time period.

At another facility, audit team members noted that the frequency of the drills differed depending on the department within the facility. Thus, the Responsible Care Department conducts annual plantwide drills while the Emergency Response Team (ERT) conducts monthly drills at the direction of the Safety Coordinator. In addition, the facility also has a Emergency Action Network Team that is responsible for responding to incidents off site and conducts drills associated with transportation-related releases.

In many instances, as indicated under the Section on Emergency Response Training, drills also involve coordination with local response organizations and neighboring facilities.

### 3.16 Community Emergency Response Coordination

*Working with local response organizations and the LEPC on emergency planning initiatives, drills and exercises, mutual aid arrangements, and other response issues completes the circle of preparedness begun with facility emergency preparedness activities. Although many facilities initially respond to and contain an emergency themselves, local first responders are normally involved in responding to those release events that threaten public health and safety. Coordination with public officials is of special importance to those facilities that depend on local responders for response to any onsite incident; appropriate responses to their hazards should be addressed in the community emergency response plan developed under EPCRA.*

All of the audited facilities work with the community to some extent with regard to emergency preparedness. As noted in the audits, many of the facilities's interaction with the community is considered commendable. Only one audited manufacturing facility maintains minimal but positive relationships with the community response department. For many facilities, community interaction consists primarily of fire prevention and pre-planning with local officials during fire inspections. However, one of the facility lacked a prefire plan with the local county public safety office. Moreover, some audited facilities have staff who are LEPC members, participate regularly in the local planning process, and distribute copies of their emergency response plan to affected parties within the community. A majority of the LEPCs have integrated the facility's Emergency Response Plan (ERP) within the county's response plan. In particular, one manufacturing facility's ERP is fully integrated with the local county disaster and emergency services response plan.

Auditors noted that a few of the commendable working relationships have been the result of the efforts of specific facility employees. In particular, one chemical manufacturing facility was noted as having an excellent relationship with the LEPCs, community action groups, and local fire departments and credited these relationships to the Safety Coordinator. In addition, another facility was noted as having good relationships with the community were due in part to efforts of current management and staff.

As discussed in the preceding section, a number of facilities also are taking advantage of opportunities to increase emergency preparedness by conducting drills and exercises with LEPCs and local response organizations. The majority of the facilities are conducting drills and exercises that include the local community. However, it was recommended that a particular facility include the county public safety office during annual emergency response drills and that another facility resume annual joint exercises with the LEPC, include the medical community in the exercises, and maintain a comprehensive list of outreach efforts.

Many of the audited facilities have adopted a proactive approach to working with the community to improve emergency response coordination. For instance, one chemical manufacturing facility works closely with the LEPC and nearby residents for awareness, training and emergency preparedness purposes. The facility holds open houses for residents in the area, and a joint effort with other industries called Good Neighbor Night, where companies provide opportunities for communicating to the public.

As discussed in the preceding section, the adoption of the Incident Command System (ICS) is commendable and very appropriate given the potential interaction with the community response agencies. Some efforts are outstanding. For example, a particular chemical manufacturing facility updates its telephone notification list quarterly by going door-to-door to verify occupants of a residence, telephone

numbers, and willingness to be placed on the automated telephone notification system. In other cases, facilities need to consider enhancing communication efforts between facilities and communities. For example, the auditors recommended to continue to support communication efforts and upgrade the siren system, and to implement an automated telephone call down system to augment public notification conducted by the police department.

# APPENDIX A
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APPENDICES

# APPENDIX B

# LIST OF CHEMICAL SAFETY AUDITS

**LIST OF CHEMICAL SAFETY AUDITS**
as of September 30, 1999

| REGION | DATE OF AUDIT | REPORT STATUS | NAME OF FACILITY |
|---|---|---|---|
| 1 | 03/22/89 | X | Polysar, Inc., Indian Orchard, MA |
| | 04/10-14/89 | X | W.R. Grace, Nashua, NH |
| | 08/03/89 | X | Fall River Treatment Plant, Fall River, MA |
| | 08/07-11/89 | X | Upjohn Co., North Haven, CT |
| | 11/29/89 | X | Bradford Soap Works, W. Warwick, RI |
| | 03/20/90 | X | Jones Chemicals, Merrimac, NH |
| | 06/20-21/90 | X | Monet Crystal Brands, Pawtucket, RI |
| | 09/12-13/90 | X | LCP Chemicals, Orrington, ME |
| | 12/17-18/90 | X | Hercules, Inc., Chicopee, MA |
| | 05/13-14/91 | X | Pacific Anchor, Cumberland, RI |
| | 07/24-25/91 | X | Rising Paper Company, Housatonic, MA |
| | 12/18/91 | X | Johnson Controls, Benington, VT |
| | 01/27-30/92 | X | Hoechst Celanese, Coventry, RI |
| | 06/25-26/92 | X | Pratt & Whitney, Southington, CT |
| | 10/28-30/92 | X | James River, Old Town, ME |
| | 05/11-14/93 | X | Monsanto, Springfield, MA |
| | 08/24-25/93 | X | Davol, Cranston, RI |
| | 03/23-25/94 | X | H.C. Starck, Newton, MA |
| | 06/14-15/94 | X | Cambridge Plating Company, Belmont, MA |
| | 07/19-22/94 | X | Georgia-Pacific, Woodland, ME |
| 2 | 08/21-24/89 | X | BASF, Rensselaer, NY |
| | **09/11/89** | | **Xerox Corporation, Webster, NY** |
| | 01/09-10/90 | X | Du Pont Agrichemicals, Manati, PR |
| | 01/11-12/90 | X | Bacardi Rum, San Juan, PR |
| | 07/31 - 08/01/90 | X | Goodyear, Niagara Falls, NY |
| | 09/10-11/90 | X | BASF, Washington, NJ |
| | 03/11-13/91 | X | C.P. Chemicals, Sewaren, NJ |
| | 06/03-05/91 | X | 3M/O-Cell-O, Tonawanda, NY |
| | 08/05-07/91 | X | Schenectady Chemicals, Schenectady, NY |
| | 03/25-26/92 | X | CPS Chemical Company, Old Bridge, NJ |
| | 06/22/92 | X | Caguas WWTP, Caguas, PR |
| | 06/23/92 | X | Puerto Nuevo WWTP, San Juan, PR |
| | 06/24/92 | X | Bayamon WWTP, Catano, PR |
| | 11/11-12/92 | X | Witco Corporation, Brooklyn, NY |
| | 6/21-23/93 | X | ArsynCo, Carlstadt, NJ |
| | **Unknown** | | **PRASA** |
| | 07/19-21/93 | X | International Paper, Ticonderoga, NY |
| | 10/12-13/93 | X | Pfizer, Barceloneta, PR |
| | 06/28-30/94 | X | Occidental Chemicals, Niagara Falls, NY |
| | 02/01-02/95 | X | Hoffman-LaRoche, Nutley, NJ |
| | **07/07/95** | | **Middlesex County WWTP, Sayreville, NJ** |
| | 09/26/96 | X-D | Patclin Chemicals, Yonkers, NY |
| | 05/06/96 | X-D | PNC, Nutley, NJ |
| | 05/07/96 | X-D | Elan Chemicals, Newark, NJ |
| | 09/12/96 | X-D | Dexter Chemical Company, Bronx, N |
| | 06/09/97 | X-D | Ecolab, Avenel, NJ |

| REGION | DATE OF AUDIT | REPORT STATUS | NAME OF FACILITY |
|---|---|---|---|
| | 06/24/97 | X-D | Clorox Company, Caguas, PR |
| | 06/25/97 | X-D | Ohmeda Caribe, Guayama, PR |
| | 09/08-09/97 | X-D | Brookhaven National Lab, Upton, NY |
| | 09/29-10/06/99 | X | Mobil Chemical Company, Edison, NJ |
| 3 | 07/30-08/03/89 | X | Rhone-Poulenc, Charleston, WV |
| | 08/14-16/89 | X | LCP Chemicals, Inc., Moundsville, WV |
| | 09/11-12/89 | X | Purolite Company, Philadelphia, PA |
| | 09/25-26/89 | X | Carl Falkenstein, Philadelphia, PA |
| | 01/31 & 02/02/90 | X | Automata, Sterling, VA |
| | 02/12-16/90 | X | Mobay Chemical, New Martinsville, WV |
| | 03/26-28/90 | X | Olin Chemical, Charleston, WV |
| | 08/20-22/90 | X | Occidental Chemicals, Delaware City, DE |
| | 01/07-10/91 | X | Rohm & Haas, Bristol, PA |
| | 04/15-16/91 | X | Anzon Lead, Philadelphia, PA |
| | 04/23-25/91 | X | DuPont Textile Fibers, Waynesboro, VA |
| | 05/21-23/91 | X | SCM Chemicals, Baltimore, MD |
| | 11/19-22/91 | X | Vista Chemicals, Baltimore, MD |
| | 02/03-07/92 | X | Allied-Signal, Hopewell, VA |
| | 04/27-29/92 | X | BP Oil Refinery, Marcus Hook, PA |
| | 07/07-10/92 | X | Huntsman Chemical Corp., Chesapeake, VA |
| | 07/28-29/92 | X | Beatrice Cheese, Whitehall, PA |
| | 11/09-11/92 | X | Allied-Signal, Philadelphia, PA |
| | 01/12-14/93 | X | Weirton Steel, Weirton, WV |
| | 03/09-11/93 | X | Koppers Industries, Follansbee, WV |
| | 05/18-20/93 | X | Merck and Company, Riverside, PA |
| | 06/22-23 & 07/14 1993 | X | Konsyl/Trinity, Easton/Salisbury, MD |
| | 09/27-29/93 | X | Allied-Signal $BF_3$ Plant, Marcus Hook, PA |
| | 11/03-05/93 | X | Hoechst Celanese, Narrows, VA |
| | 02/23-24/94 | X | Jones Chemicals, Milford, VA |
| | 04/06-08/94 | X | GE Specialty Chemicals, Morgantown, WV |
| | 04/20-22/94 | X | PPG Industries, New Martinsville, WV |
| | 05/11-13/94 | X | Armstrong World Industries, Lancaster, PA |
| | 06/01-03/94 | X | Carpenter Technology, Reading, PA |
| | 09/19-21/94 | X | Union Camp, Franklin, VA |
| | 11/11-13/94 | X | Air Products and Chemicals, Hometown, PA |
| | 01/10-11/95 | X | Standard Chlorine, Delaware City, DE |
| | 02/06-08/95 | X-D | Sunoco Girard Point, Philadelphia, PA |
| | 02/14-16/95 | X | Blue Plains WWTP, Washington, DC |
| | 07/11-13/95 | X-D | Cytec Industries, Willow Island, WV |
| 4 | 03/20-24/89 | X | Royster Phosphate, Piney Point, FL |
| | 05/01-05/89 | X | Olin Corporation, Charleston, TN |
| | 07/11/89 & 08/03-04/89 | X | Armco Steel, Ashland, KY |
| | 07/18-20/89 | X | Kerr McGee, Hamilton, MS |
| | 08/17/89 & 09/11-15/89 | X | Texas Gulf, Aurora, NC |
| | 02/12-13/90 | X | Photocircuits Atlanta, Peachtree City, GA |
| | 02/26-03/02/90 | X | Kemira, Savannah, GA |
| | 04/04-05/90 | X | Astrotech, Titusville, FL |

| REGION | DATE OF AUDIT | REPORT STATUS | NAME OF FACILITY |
|---|---|---|---|
| | **05/08-11/90** | | **Cardinal Chemical Co., Columbia, SC** |
| | 09/11-13 & 24-27/90 | X | Tennessee Chemical Co., Copper Hill, TN |
| | 10/26/90 | X | Kason Industries, Newnan, GA |
| | 11/29/90 | X | C & S Chemical Company, Austell, GA |
| | 12/4-5/90 | X | Carolina Solite, Norwood, NC |
| | 12/4-5/90 | X | Oldover Corporation, Albemarle, NC |
| | 12/12/90 | X | Tull Chemical Company, Oxford, AL |
| | 01/07-10/91 | X | Peridot Chemical Company, Augusta, GA |
| | 01/22-25/91 | X | Aqua Tech/Groce Labs, Duncan, SC |
| | 01/30-31/91 | X | Virtex Chemicals, Bristol, TN |
| | 02/20-21/91 | X | Water Treatment Plant, Cape Coral, FL |
| | 02/25-26/91 | X | Canal Pumping Station, Cape Coral, FL |
| | 03/04-08/91 | X | Kentucky American Water, Lexington, KY |
| | 03/19/91 | X | Drexel Chemical Co., Tunica County, MS |
| | 03/27/91 | X | Columbia Organics, Camden, SC |
| | 04/02/91 | X | Armstrong Glass, Atlanta, GA |
| | 08/26-29/91 | X | B. F. Goodrich, Calvert City, KY |
| | 11/12-14/91 | X | West Lake Monomers, Calvert City, KY |
| | 01/21-24/92 | X-ND | Piney Point Phosphates, Piney Point, FL |
| | 03/24-26/92 | X | Reichold Chemicals, Kensington, GA |
| | 04/28-05/01/92 | X | G.E. Lighting Systems, Hendersonville, NC |
| | 07/20-21/92 | X | Jones Chemicals, Charlotte, NC |
| | 08/25-26/92 | X-ND | Peridot Chemical Company, Augusta, GA |
| | 08/03-07/92 | X | Velsicol Chemicals, Chattanooga, TN |
| | 11/16-20/92 | X | Mississippi Chemicals, Yazoo City, MS |
| | 01/04-08/93 | X | DuPont, Louisville, KY |
| | 02/01-02/93 | X | IMC Fertilizer, Tampa, FL |
| | 02/02-03/93 | X | Seminole Fertilizer, Tampa, FL |
| | 02/04-05/93 | X | CF Industries, Tampa, FL |
| | 03/29-04/02/93 | X | Jones Chemicals, Mobile, AL |
| | 03/29-04/02/93 | X | Occidental Chemicals, Mobile, AL |
| | 07/12-13/93 | X | Trojan Battery, Lithonia, GA |
| | 08/02-06/93 | X | Ciba-Geigy, McInstosh, AL |
| | 11/29-12/02/93 | X | High Point Chemicals, High Point, NC |
| | 12/07-08/93 | X | Grady Hospital, Atlanta, GA |
| | 01/11-13/94 | X | Albright and Wilson, Charleston, SC |
| | 02/07-11/94 | X | Sherwin-Williams, Richmond, KY |
| | 04/05-06/94 | X | Allied Universal, Leesburg, FL |
| | 04/15-29/94 | X | First Chemical Corporation, Pascagoula, MS |
| | 04/26-28/94 | X | Witco Corporation, Memphis, TN |
| | 07/11-15/94 | X | General Electric, Burkville, AL |
| | 10/17/94 | X | Ashland Petroleum, Ashland, KY |
| | 11/01-03/94 | X | Holox Limited, Union City, GA |
| | 11/14-18/94 | X | Tennessee Eastman, Kingsport, TN |
| | 12/12-15/95 | X | Union Carbide Corporation, Tucker, GA |
| | 01/24-27/95 | X | PCR, Gainesville, FL |
| | 01/30-02/03/95 | X | Scott Paper Company, Mobile, AL |
| | 04/17-21/95 | X | Henkel Corporation, Charlotte, NC |
| | 06/04-09/95 | X | Arcadian Fertilizer, Augusta, GA |
| | 06/19-23/95 | X | American Synthetic Rubber, Louisville, KY |

| REGION | DATE OF AUDIT | REPORT STATUS | NAME OF FACILITY |
|---|---|---|---|
| | 11/27-12/01/95 | X | Degussa Corporation, Theodore, AL |
| | 02/12-16/96 | X-R | Vicksburg Chemical Company, Vicksburg, MS |
| | 02/13-15/96 | X-R | Gilman Paper Company, St. Marys, GA |
| | 04/15-19/96 | X-R | CONDEA Vista, Aberdeen, MS |
| | 07/15-19/96 | X-R | Vinings Industries, Marietta, GA |
| | 11/18-22/96 | X-R | Great Lakes Chemical, Newport, TN |
| | 02/10-14/97 | X-R | Riverwood International, Macon, GA |
| | 03/17-21/97 | X-R | Platte Chemical Corporation, Greenville, MS |
| | 05/05-09/97 | X-R | MAPCO, Memphis, TN |
| | 09/22-26/97 | X-R | Halocarbon Products, North Augusta, SC |
| | 11/03-07/97 | X-R | DuPont Fluoroproducts, Louisville, KY |
| | 11/14/97 | X-R | Sony Music, Carrollton, GA |
| | 01/12-16/98 | X-R | NIPA Hardwicke, Elgin, SC |
| | 02/09-13/98 | X-R | Shell Chemical, Mobile, AL |
| | 07/20-23/98 | X-R | Eastman Chemicals, Eastman, South Carolina |
| | 08/97 - 11/99 | X-R | Monfort, Inc., Grand Island, NE |
| | 01/25-29/99 | X-R | BP Amoco Chemicals, Decatur, AL |
| | 02/08-12/99 | X-R | Borden Chemical, Inc., Louisville, KY |
| | 03/08-12/99 | X-R | Arch Chemical, Inc., Brandenburg, KY |
| | 04/19-23/99 | X-R | Dow Corning Corporation, Carollton, KY |
| | 0517-21/99 | X-R | Hunt Refining Company, Tuscaloosa, AL |
| | 06/11-15/99 | X-R | 3M Specialty Materials Division, Decatur, AL |
| | 07/12-16/99 | X-R | Albemarle Corporation, Orangeburg, SC |
| 5 | 07/25-28/89 | X | Koppers, Cicero, IL |
| | 08/08-11/89 | X | Best Foods, Chicago, IL |
| | 09/15/89 | X-D | Shell Oil, Wood River, IL |
| | 03/05/90 | X-D | Eli Lilly, Clinton, IN |
| | 03/26-30/90 | X-D | Anderson Development, Adrian, MI |
| | 04/14-18/90 | X | General Electric Plastics, Mt. Vernon, IN |
| | 06/11-15/90 | X-D | Tremco, Inc., Cleveland, OH |
| | 07/16-19/90 | X-D | Flexel, Inc., Covington, IN |
| | 03/18-20/91 | X | Detroit Edison, River Rouge, MI |
| | 05/20-22/91 | X | Nalco Chemical Company, IL |
| | 08/12-14/91 | X | SCM Chemicals, Ashtabula, OH |
| | 03/10-12/92 | X | Elf Atochem, Riverview, MI |
| | 04/21-23/92 | X | BASF Corporation, Wyandotte, MI |
| | 06/02-04/92 | X | G.E. Superabrasives, Worthington, OH |
| | 11/03-05/92 | X | Yenkin-Majestic Paints, Columbus, OH |
| | 12/15-17/92 | X | Allison Gas Turbine, Indianapolis, IN |
| | 04/13-15/93 | X | Lomac Corporation, Muskegon, MI |
| | 06/15-17/93 | X | Specialty Chem, Marinette, WI |
| | 07/20-21/93 | X | Witco, Chicago, IL |
| | 08/17-18/93 | X | Interplastic, Minneapolis, MN |
| | 03/29-31/94 | X | Upjohn Company, Portage, MI |
| | 08/31-09/01/94 | X | Stepan Company, Elwood, IL |
| | 10/11-12/94 | X | Farley Company, Brimfield, OH |

| REGION | DATE OF AUDIT | REPORT STATUS | NAME OF FACILITY |
|---|---|---|---|
| | 02/21-23/95 | X | Capital Resin Corporation, Columbus, OH |
| | 05/02-04/95 | X | Clark Refining and Marketing, Blue Island, IL |
| | 06/06-08/95 | X | Spectrulite Consortium, Madison, IL |
| | 08/15-17/95 | X | Waldorf Corporation, St. Paul, MN |
| | 07/09-11/96 | X-D | Hydrite Chemical, Oshkosh, WI |
| | 09/22-24/96 | X-D | ISP Fine Chemicals, Columbus, OH |
| 6 | 06/13/89 | X | Western Extrusion, Carrollton, TX |
| | 08/30-31/89 | X | Great Lakes Chemical Co., El Dorado, AR |
| | 08/15-16/89 | X | Farmland Industries, Enid, OK |
| | 09/12-13/89 | X | Fermenta ASC Corporation, Houston, TX |
| | 10/16-17/89 | X | Chief Supply, Haskell, OK |
| | 11/06-07/89 | X | Phillips Petroleum, Pasadena, TX |
| | 11/14/89 | X | Texas Instruments, Dallas, TX |
| | 01/17-18/90 | X | Exxon Refinery, Baton Rouge, LA |
| | 04/17-19/90 | X | Olin Chemicals, Lake Charles, LA |
| | 03/05-06/91 | X | Sid Richardson Carbon Co., Borger, TX |
| | 03/20-22/91 | X | ARCO Chemical, Channelview, TX |
| | 05/01-03/91 | X | Citgo Refinery, Lake Charles, LA |
| | 07/09-11/91 | X | International Paper, Pine Bluff, AR |
| | 08/27-29/91 | X | Agricultural Minerals, Catoosa, OK |
| | 02/25-26/92 | X | Safety-Kleen Corporation, Denton, TX |
| | 06/09-10/92 | X | Halliburton Services, Caldwell, TX |
| | 08/17-18/92 | X | Houston Woodtech, Houston, TX |
| | 08/24/92 | X | Allied-Signal, Geismar, LA |
| | 11/17-18/92 | X | CPS Chemicals, West Memphis, AR |
| | 03/16-17/93 | X | Labbco, Inc., Slidell, LA |
| | 08/31-09/03/93 | X | Chevron USA, El Paso, TX |
| | 09/08-09/93 | X | Harcros Chemicals, Dallas, TX |
| | 10/05-07/93 | X | Ethyl Corporation, Magnolia, AR |
| | 12/14-15/93 | X | Champion Technologies, Odessa, TX |
| | 06/07-09/94 | X | Phillips 66, Borger, TX |
| | 08/23-25/94 | X | Sterling Chemicals, Texas City, TX |
| | 11/01/94 | X | Creamland Dairies, Albuquerque, NM |
| | 11/02/94 | X | DPC Industries, Albuquerque, NM |
| | 11/15-17/94 | X | Navajo Refining Company, Artesia, NM |
| | 08/22-25/95 | X-D | Formosa Plastic, Point Comfort, TX |
| 7 | 10/25/90 | X | ICI Americas, Omaha, NE |
| | 11/20/90 | X | Jacobson Warehouse, Des Moines, IA |
| | 05/01/91 | X | ABB Power Transformers, St. Louis, MO |
| | 07/31/91 | X | Hydrozo, Inc., Lincoln, NE |
| | 12/04/91 | X | Rhone-Poulenc, Sedalia, MO |
| | 05/06-07/92 | X | American Cyanamid, Hannibal, MO |
| | 06/15-16/92 | X | Proctor and Gamble, Kansas City, KS |
| | 06/22-23/92 | X | Hercules Aqualon Company, Louisiana, MO |
| | 07/15/92 | X | Cotter and Company, Kansas City, MO |
| | 08/17-18/92 | X | Cornbelt Chemical Company, McCook, NE |
| | 08/31/92 | X | Eagle Lithographing, Kansas City, MO |
| | 09/03/92 | X | Independence WWTP, Sugar Creek, MO |

| REGION | DATE OF AUDIT | REPORT STATUS | NAME OF FACILITY |
|---|---|---|---|
| | 09/30/92 | X | Flexel, Inc., Tecumseh, KS |
| | 12/16/92 | X | Arcadian Fertilizer, Clinton, IA |
| | 12/18/92 | X | Rock Creek WWTP, Independence, MO |
| | 04/26/93 | X | Rhone-Poulenc AG, St. Louis, MO |
| | 05/13/93 | X | LaRoche Industries, Crystal City, MO |
| | 05/11/93 | X | Golden Valley Cheese, Clinton, MO |
| | 06/03/93 | X | Total Petroleum, Arkansas City, KS |
| | 06/29/93 | X | Farmland Petroleum, Coffeyville, KS |
| | 07/08/93 | X | AG Processing, Eagle Grove, IA |
| | 07/21/93 | X | Farmland Industries, Lawrence, KS |
| | 07/29/93 | X | Beech Aircraft, Wichita, KS |
| | 08/05/93 | X | Ralph Green Plant, Pleasant Hill, MO |
| | 10/11/93 | X | Whitmire Research Lab, Valley Park, MO |
| | 10/12/93 | X | Doe Run Company, Herculaneum, MO |
| | 11/09/93 | X | Ecolab Pest Elimination, Kansas City, MO |
| | 11/30/93 | X | Carmar Group, Carthage, MO |
| | 01/13/94 | X | Cook Composites, N. Kansas City, MO |
| | 02-05/94 | X | Van Waters and Rogers, St. Louis, MO |
| | 02/11/94 | X | Wells' Dairy, Le Mars, IA |
| | 02/15-07/18/94 | X | 3M, Springfield, MO |
| | 02/17/94 | X | Armour Swift-Eckrich Plant, Kansas City, MO |
| | 02/28/94 | X | Terra International, Sergeant Bluff, IA |
| | 04/19/94 | X | Seitz Foods, St. Joseph, MO |
| | 04/28/94 | X | Fleming Foods, Sikeston, MO |
| | 05/04-06/94 | X | Mallinckrodt Chemicals, St. Louis, MO |
| | 06/22/94 | X | Meadow Gold Dairies, Des Moines, IA |
| | 06/23/94 | X | 3M Commercial Graphics, Nevada, MO |
| | 07/08/94 | X | ICI Explosives, Joplin, MO |
| | 09/15/94 | X | BioKyowa, Cape Girardeau, MO |
| | 09/29-30/94 | X | Elf Atochem, Wichita, KS |
| | 11/08/94 | X | IES Industries, Marshalltown, IA |
| | 11/10/94 | X | Dyno-Nobel, Louisiana, MO |
| | 11/28/94 | X | Vulcan Chemicals, Wichita, KS |
| | 12/30/94 | X | Chemcentral, Maryland Heights, MO |
| | 12/31/94 | X | Hudson Foods, Noel, MO |
| | 01/17/95 | X | Nat. Coop. Refinery Assoc., McPherson, KS |
| | 01/31/95 | X | St. Louis Water Company, Florissant, MO |
| | 02/09/95 | X | Howard Bend WWTP, Chesterfield, MO |
| | 03/28/95 | X | Chemtech, Kansas City, MO |
| | 05/08/95 | X | Douglas Battery, N. Kansas City, MO |
| | 05/12/95 | X | Slay Bulk Terminals, St. Louis, MO |
| | 06/13/95 | X | Extrusions, Fort Scott, KS |
| | 06/16/95 | X | Philip Environmental, Kansas City, MO |
| | 07/14/95 | X-R | Wagner Brake, Berkeley, MO |
| | 09/14/95 | X | Foamex, Cape Girardieu, MO |
| | 02/12/96 | X-R | Siegwerk, Inc., Greenfield, IA |
| | 04/09/96 | X-R | Koch Sulfur Products, DeSoto, KS |
| | 08/08/96 | X-R | General Motors, Kansas City, KS |
| | 11/04/96 | X-R | Owens-Corning, Kansas City, KS |
| | 11/08/96 | X-R | Tyson Foods, Monett, MO |

| REGION | DATE OF AUDIT | REPORT STATUS | NAME OF FACILITY |
|---|---|---|---|
| | 12/13/96 | X-R | Copeland Corporation, Lebanon, MO |
| | 01/29/97 | X-R | United Refrigeration Services, Wichita, KS |
| | 10/02/97 | X-R | Agrium Homestead Nitrogen, Beatrice, NE |
| | 10/07/97 | X-R | Morton International, Hutchinson, KS |
| | 02/10/98 | X-R | Reames Foods, Clive, IA |
| | 08/05/98 | X-R | LaRoche Industries, Crystal City, MO |
| | 10/97 - 02/99 | X | PCS Nitrogen, Clinton, IA |
| 8 | 05/02-04/89 | X | Phillips Refinery, West Bountiful, UT |
| | 06/13-15/89 | X | Chevron Chemical, Rock Springs, WY |
| | 08/15-17/89 | X | Western Forge, Colorado Springs, CO |
| | 03/27/90 | X | Koppers Industries, Denver, CO |
| | 05/15-17/90 | X | Amoco Production Company, Powell, WY |
| | 06/26-29/90 | X | Amoco Casper Refinery, Casper, WY |
| | 08/27-31/90 | X | Western Zirconium, Ogden, UT |
| | 11/01/90 | X | Jemm Plating, Co., Denver, CO |
| | 02/06-07/91 | X | SAS Circuits, Littleton, CO |
| | 02/19-21-91 | X | Kodak-Colorado Division, Windsor, CO |
| | 04/30-05/03/91 | X | Col. Falls Aluminum, Columbia Falls, MT |
| | 05/29-31/91 | X | Syncom Techologies, Mitchell, SD |
| | 09/29-30/91 | X | LaRoche Industries, Orem, UT |
| | 11/12-13/91 | X | T.G. Soda Ash, Granger, WY |
| | 02/18-20/92 | X | Coastal Chemical, Cheyenne, WY |
| | 02/25-27/92 | X | Chevron Refinery, Salt Lake City, UT |
| | 05/27-29/92 | X | Rhone-Poulenc, Butte, MT |
| | 08/18-19/92 | X | ALCHEM, Ltd., Grafton, ND |
| | 02/09-12/93 | X | Stone Container Corp., Missoula, MT |
| | 05/18-21/93 | X | Magnesium Corp., Salt Lake City, UT |
| | 06/15-18/93 | X | Frontier Refining, Cheyenne, WY |
| | 09/08-10/93 | X | Koch Sulfur Products, Riverton, WY |
| | 03/01-04/94 | X | Dakota Gasification, Mercer County, ND |
| | 05/03-06/94 | X | John Morrell, Sioux Falls, SD |
| | 06/07-10/94 | X | Huish Detergents, Salt Lake City, UT |
| | 09/13-15/94 | X | Montana Refining, Great Falls, MT |
| | 07/10-14/95 | X-D | Coors Brewing Company, Golden, CO |
| | 08/29-31/95 | X-D | Anheuser Busch Brewer, Fort Collins, CO |
| | 09/18-21/95 | X-D | Sinton Dairy Foods, Colorado Springs, CO |
| 9 | 05/12-13/89 | X | Nunes Cooling, Salinas, CA |
| | 07/25-27/89 | X | Unocal Chemical, Brea, CA |
| | 08/16-17/89 | X | Eticam of Nevada, Fernley, NV |
| | 09/07-08/89 | X | Coronado Generator, St. Johns, AZ |
| | 04/17-20/90 | X | Ultramar Refinery, Wilmington, CA |
| | 06/19-22/90 | X | Magma Copper, San Manuel, AZ |
| | 07/17-20/90 | X | Pioneer Chlor-Alkalai, Henderson, NV |
| | 09/10-16/90 | X | Dole Packaged Foods, Honolulu, HI |
| | 04/09-12/91 | X | Motorola, Phoenix, AZ |
| | 07/16-19/91 | X | Dow Chemicals, Pittsburg, CA |

| REGION | DATE OF AUDIT | REPORT STATUS | NAME OF FACILITY |
|---|---|---|---|
| | 08/20/91 | X-ND | Pioneer Chlor-Alkalai, Henderson, NV |
| | 08/21-23/91 | X | Timet Corporation, Henderson, NV |
| | 02/11-14/92 | X | Brewer Environmental Services, Honolulu, HI |
| | 06/08/92 | X | General Chemical Corporation, Pittsburg, CA |
| | 07/14-17/92 | X | Chevron Refinery, Richmond, CA |
| | 08/24-27/92 | X | Shell Oil Refinery, Martinez, CA |
| | 02/23-24/93 | X | Brewer Environmental Services, Honolulu, HI |
| | 05/04-05/93 | X | Union Pacific Railroad, Stockton, CA |
| | 07/27-30/93 | X | Louisiana Pacific Pulp Mill, Samoa, CA |
| | 04/12-15/94 | X | ATSF Rail Yard, Barstow, CA |
| | 07/19-21/94 | X | General Chemical Corporation, Pittsburg, CA |
| | 10/06-08/94 | X | Kerley Ag, Antioch, CA |
| | 12/05-08/94 | X | Southern Pacific Lines, Long Beach, CA |
| | 08/14-15/95 | X-D | Pimalco, Chandler, AZ |
| | 08/16/95 | X-D | Solkatronic Chemical, Chandler, AZ |
| | 08/05-09/96 | X-ND | Puna Geothermal Venture, Hawaii |
| 10 | 07/27/89 | X | All Pure Chemical Company, Kalama, WA |
| | 08-10/89 | X | ITT Rayonier, Port Angeles, WA |
| | 09/12-15/89 | X | McWhorter Northwest, Portland, OR |
| | 03/19-23/90 | X | BP Oil Company, Ferndale, WA |
| | 04/23-27/90 | X | FMC Corporation, Pocatello, ID |
| | 05/14-18/90 | X | Neste Resins, Springield, OR |
| | 09/24-28/90 | X | Unocal Chemicals, Kenai, AK |
| | 01/08/91 | X | Occidental Chemicals, Tacoma, WA |
| | 01/15-18/91 | X | Chevron USA, Seattle, WA |
| | 03/18-22/91 | X | James River Corporation, Clatskanie, OR |
| | 04/22-26/91 | X | Potlatch Corporation, Lewiston, ID |
| | 07/23-26/91 | X | Great Western Chemical Co., Nampa, ID |
| | 08/05-09/91 | X | Boise Cascade Mill, Wallula, WA |
| | 02/24-28/92 | X | Georgia-Pacific Paper Division, Toledo, WA |
| | 03/23-27/92 | X | SEH America, Vancouver, WA |
| | 04/28-05/01/92 | X | Amalgamated Sugar Company, Twin Falls, ID |
| | 07/27-31/92 | X | ALCOA, Wenatchee, WA |
| | 11/16-20/92 | X | Weyerhauser Company, Springfield, OR |
| | 01/25-29/93 | X | Wacker Siltronics, Portland, OR |
| | 04/12-16/93 | X | Ponderay Newsprint, Usk, WA |
| | 07/26-27/93 | X | Darigold, Caldwell, ID |
| | 07/28-29/93 | X | Simplot, Caldwell, ID |
| | 10/25-29/93 | X | Unocal, Kennewick, WA |
| | 02/14-17/94 | X | Boise Cascade, Medford, OR |
| | 03/22-25/94 | X | Ocean Spray, Markham, WA |
| | 06/20-24/94 | X | Elf Atochem, Portland, OR |
| | 11/14-15/94 | X | Southern Oregon Marine, Coos Bay, OR |
| | 11/16/94 | X | South Coast Lumber, Brookings, OR |
| | 02/27-03/03/95 | X | Georgia-Pacific, Bellingham, WA |
| | 06-05-09/95 | X | American Microsystems, Pocatello, ID |
| | 11/13-17 and 12/11-13/95 | X-D | Kalama Chemical, Kalama, WA |
| | 04/08-11/96 | X-D | Blount International, Lewiston, ID |

| REGION | DATE OF AUDIT | REPORT STATUS | NAME OF FACILITY |
|---|---|---|---|
| | 07/08-11/96 | X-D | Fujitsu Microelectronics, Gresham, OR |

Notes:

1. "X" indicates that the final report has been received, and the profile has been entered into the database.

2. "X-R" indicates that the final report and the profile has been received, and the profile will be finalized.

3. "X-D" indicates that only the final report has been received, and the profile will be developed and completed.

4. "X-ND" indicates that the final report has been received, but no profile will be prepared because the audit was a follow-up visit, rather than a new audit.

5. **Bold** text indicates that the final report has not yet been received.

6. The audit conducted by Region 10 at ITT Rayonier in Port Angeles, WA, occurred over a period of several months.