Introduction

A chemical safety vulnerability is defined as a condition or circumstance that might result in the following:

- ***fires or explosions from uncontrolled chemical reactions,***
- ***exposure of workers or the public to hazardous chemicals, or***
- ***releases of hazardous chemicals to the environment.***

As part of the Department of Energy's (DOE) effort to improve its understanding and management of risks associated with the handling, use, treatment, storage, and disposal of hazardous chemicals, the Secretary of Energy initiated a comprehensive review of chemical safety practices and programs to identify chemical safety vulnerabilities confronting the DOE complex. The Chemical Safety Vulnerability Review was performed in recognition of the extent, diversity, and (all too often) uncharacterized condition of hazardous chemicals at many DOE facilities. Conducting the Chemical Safety Vulnerability Review at this time was particularly important because of the fundamental shift in the Department's mission away from defense nuclear production and toward environmental cleanup and restoration. This change in mission represents a significant challenge to DOE because of the difficulties inherent in cleanup of chemicals during decontamination and decommissioning (D&D) operations, the Department's limited experience with such activities, and the difficulties associated with recognizing and analyzing the chemical hazards likely to be posed by these activities.

The Office of Environment, Safety and Health (EH) was directed to lead this assessment, and the Assistant Secretary for Environment, Safety and Health established the Chemical Safety Vulnerability Working Group to manage its overall implementation. (See Appendix A, "Tasking Memorandums.") The Working Group consisted of line management representatives from DOE and contractor organizations, including a core group of EH personnel. (See Attachment 2 of Appendix B for a list of Working Group members.)

The Chemical Safety Vulnerability Review was conducted between February and July 1994 and involved the identification of chemical safety vulnerabilities for a cross section of DOE sites and facilities (i.e., 148 facilities at 29 sites), as shown in Figure 1. A sampling approach was adopted because, given the widespread use of chemicals across the Department, a comprehensive survey was not possible within the timeframe provided. The sites and facilities reviewed form a representative sample of chemicals used, chemical safety practices and programs in place, operations and processes conducted, and types and extent of chemical safety issues confronting DOE. This report documents the findings of the Chemical Safety Vulnerability Working Group.

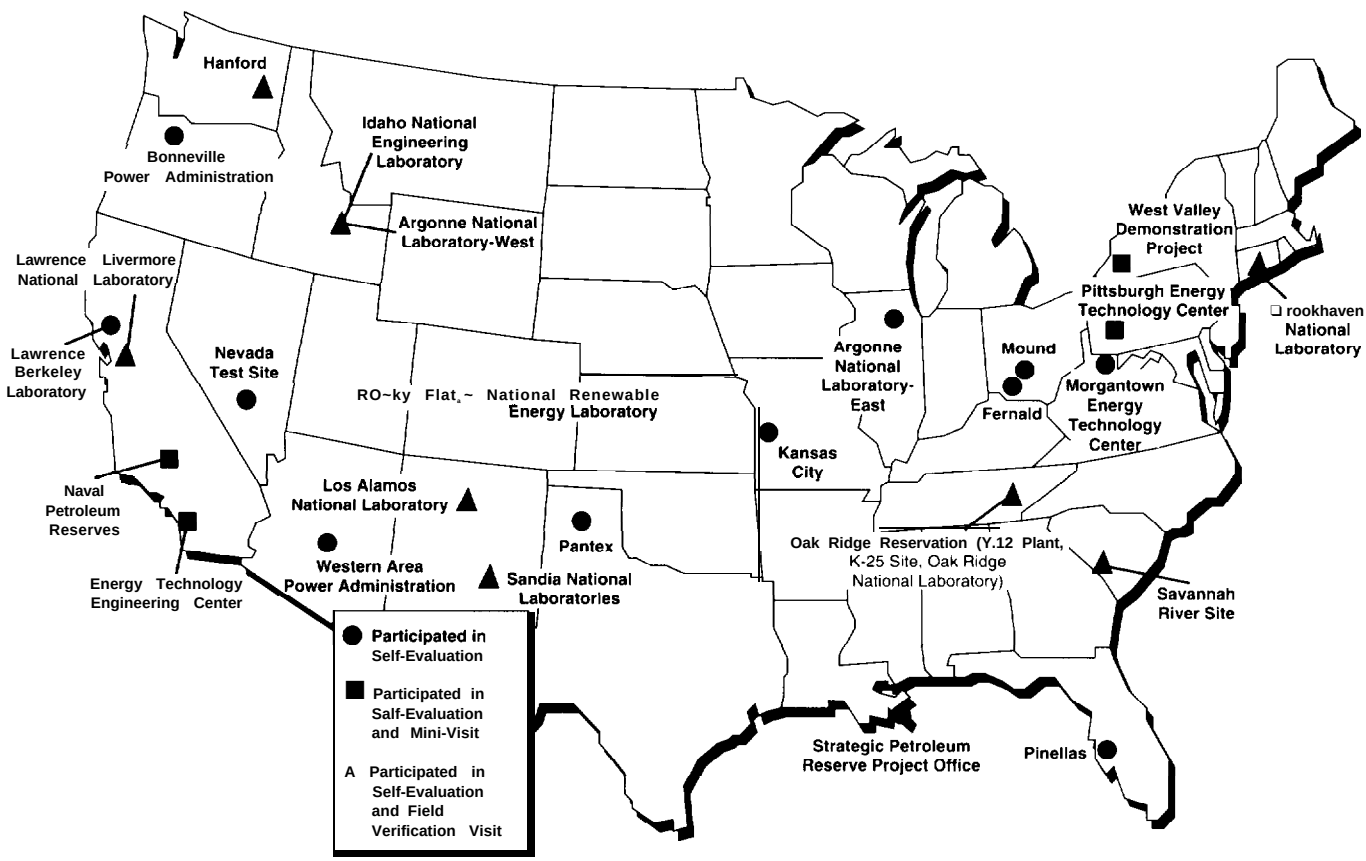

Figure 1. **Sites Participating in the Chemical Safety Vulnerability Review**

Background

Carrying out the various historic missions of the DOE complex has required the use of numerous chemicals, ranging from common acids, bases, oxidizing agents, solvents, heavy metals, and maintenance reagents (e. g., oils, greases, paints, and adhesives) to specialty organics, explosives, hydrocarbon fuels, and toxic, corrosive, or flammable gases. (See Appendix R.) The quantities used vary widely (ranging from small laboratory quantities to large volumes of hazardous chemicals needed for manufacturing or large-scale processing operations), sometimes exceeding the threshold quantities established by the Occupational Safety and Health Administration's (OSHA) chemical process safety management rule (29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals, " dated June 1, 1992). (See Table 1 for a list of DOE facilities that exceed OSHA-established thresholds for hazardous chemicals.) In addition, DOE facilities treat, store, and dispose of a variety of hazardous wastes (which are regulated under the Resource Conservation and Recovery Act, or RCRA) and polychlorinated biphenyls (which are regulated under the Toxic Substances Control Act). To complicate matters further, some of these chemical wastes are contaminated with radionuclides.

Table 1. **DOE Sites and Facilities Covered by the OSHA Process Safety Management Rule**

Site	Chemical (threshold quantity)	Quantity (in pounds)	Process and Location
ALBUQUERQUE OPERATIONS OFFICE			
Los Alamos National Laboratory (LANL)	Chlorlne (1 .500 lbs)	4,000	Waste Water Treatment Facility Building 340
LANL (future process)	Hydrochloric Acid (30°0 or greater. 15,000 lbs.)	47,885	Nuclear Materials Processing/Chlorlde Systems
Mound	Explosives (any amount)	unknown	Residuals/Equipment and Components
Pantex	Explosives (any amount)	4400	Parts & Scraps/Explosives Machining Facilties
Pinellas	Explosives (any amount)	unknown	Residuals/Equlpment and Components
FOSSIL ENERGY			
Naval Petroleum Reserves in California (NPRC)	Crude 011 (10,000 lbs)	N/A	011 Production/Pipelines
NPRC	Propane Liquid (10,000 lb.)	370000	SeparationGas Operations
NPRC	Butane Liquid (10,000 lbs)	440,000	Separation{Gas Operations
NPRC	Isobutane Liquid (10,000 lbs)	490,000	Separation, Gas Operations
NPRC	Ethyl Mercaptan (10.000 lbs)	14,800	Odorant/Gas Operations
NPRC	Nitrogen Oxide (250 lb,.)	250	Lab/Gas Operations
NPRC (under construction)	Anhydrous Ammonia (10.000 lbs)	32.000	Cogeneration Plant Gas Operations
Naval Petroleum Reserve No 3 in Wyoming (NPR-3)	Crude 0il (10.000 lb,)	N/A	0il Production Pipline
NPR-3	Butane (10,000 lbs)	74,970	Low Temperature Separation Gas Plant
NPR-3	Propane (10,000 lbs)	68,800	Low Temperature Separation Gas Plant
Strategic Petroleum Reserve-New Orleans	Crude 011 (10,000 lbs)	140 trillion lbs in 65 separate caverns	Storage Caverns

The information in the table is based on data available from site contacts and has not been field verified. (Hydrocarbon fuel exempted by the Occupational Safety and Health Administration has not been included.)

Table 1 (continued). **DOE Sites and Facilities Covered by the OSHA Process Safety Management Rule**

Site	Chemical (threshold quantity)	Quantity (in pounds)	Process and Location
OAKLAND OPERATIONS OFFICE			
Energy Technology Engineering Center (ETEC)	Anhydrous Ammonia (10,000 lbs.)	12,000	Cycle Demo Plant/Kalina
ETEC	Ammonia (44% or greater, 15,000 lbs.)	66,400	Cycle Demo Plant/Kalina
Lawrence Berkeley Laboratory	Nitric Acid >94.5 °/. (500 lbs.)	1,000	Plating Shop/Bulldlng 77
Lawrence Livermore National Laboratory	Explosives (any amount)	Unknown	300 Area
OAK RIDGE OPERATIONS OFFICE			
Y-1 2 Plant	Hydrochloric Acid (30%. or greater, 15,000 lbs.)	294,000	Disassembly and Special Materials
Y-1 2 Plant	Hydrogen Fluoride (1,000 lbs)	11,000	From inactive process, in storaqe/Building 9212
Y-1 2 Plant	Nitrogen Oxide (250 lb.,)	1,700	From inactive process, in storage/Building 9212
Y.12 Plant	Methanol (10,000 lbs.)	350,000 gals	Brine Cooling System/ Utilities
K-25 Site	Chlorine (1,500 lbs,)	2,000	Recirculating Cooling Water/K-802
K-25 Site	Chlorine (1,500 lbs)	4,300	Sanitary Water/K-1515
K-25 Site	Chlorine(l,5001bs)	6,000	Chlorine Storage,K1058
Oak Ridge National Laboratory	Explosives (any amount)	Unknown	Explosives A Storage Shed/Building 7666
Y-1 2 Plant	Chlorine (1 ,500 lbs)	16,000	Chlorine Water Treatment Plant
RICHLAND OPERATIONS OFFICE			
Hanford	Chlorine (1 ,500 lbs.)	12,000	Storage/l 183-D
Hanford	Chlorine (l,5001bs)	6,000	Water Treatment/283-W
Hanford	Chlorine (l,500 lbs)	8,000	Water Treatment/26-E
Hanford	Chlorine (1 ,500 lbs.)	4,000	Water Treatment/315
Hanford	Chlorine (1,500 lbs.)	4,000	Waler Disinfection/183-N
Hanford	Chlorine (1 ,500 lbs.)	4,000	Water Disinfection/183-KE
ROCKY FLATS OFFICE			
Rocky Flats Plant	Chlorine(l,5001bs)	2,250	Compressed Gas Storage

The information in the table is based on data available from site contacts and has not been field verified. (Hydrocarbon fuel exempted by the Occupational Safety and Health Administration has not been included.)

An analysis of events reported in DOE's Occurrence Reporting and Processing System over the past 20 months indicates that more than 600 occurrences—an average of about one per day—involved chemical safety concerns. These occurrence reports are periodically analyzed and categorized into classes, depending on the severity (or potential severity) of their impact on worker health and safety, the public, or the environment. Class 1 and 2 events represent the most significant occurrences. Significant events involving chemical safety occur at an average rate of more than once per week. (Figure 2 provides DOE occurrence data related to chemical safety for the past 20 months.) Some of these significant events have involved personnel injuries (e.g., burns); others (e.g., spills, sprays, reactions) have resulted in environmental releases. The Chemical Safety Vulnerability Review was designed to identify conditions and circumstances contributing to such events and to specify mitigating actions to prevent their recurrence.

The Department of Energy is undergoing a dramatic shift in missions as the United States enters the post-Cold War era. The size of the nuclear weapons complex is being sharply reduced, and the Department is redirecting its emphasis from nuclear weapons

production toward environmental cleanup and the development of new energy technologies. This change in emphasis is illustrated by an analysis of departmental funding, depicted in Figure 3.

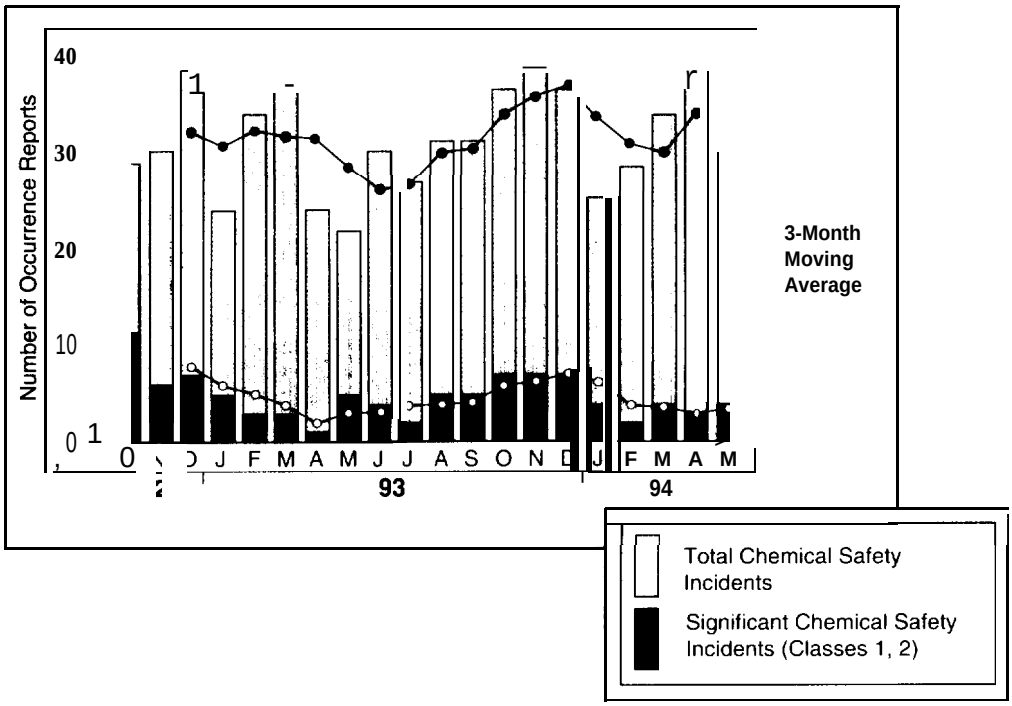

Figure 2. **Occurrence Reports Associated with Chemical Safety Incidents**

DOE and its predecessor agencies have operated a wide range of facilities (including laboratories) that use and store hazardous chemicals. Despite sophisticated engineered safety systems and administrative controls at some of these facilities, chemical safety vulnerabilities persist. Many of the facilities used for defense nuclear production were constructed during or shortly after World War II and incorporated few of the safety systems and facility design features currently required by the Department. Several factors affect

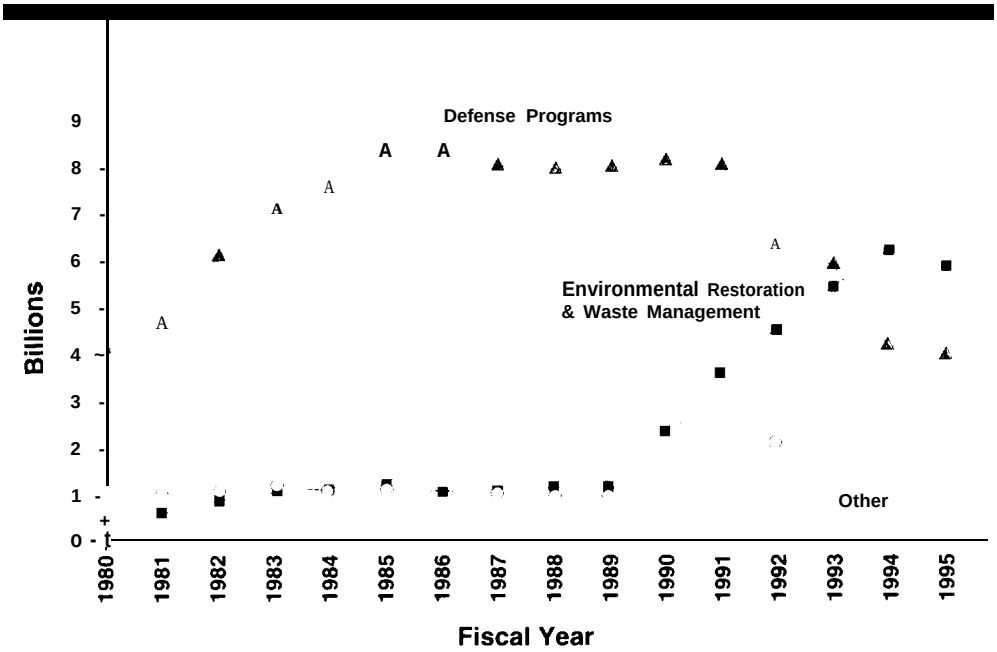

Figure 3. **Historical Funding Levels for Departmental Activities**

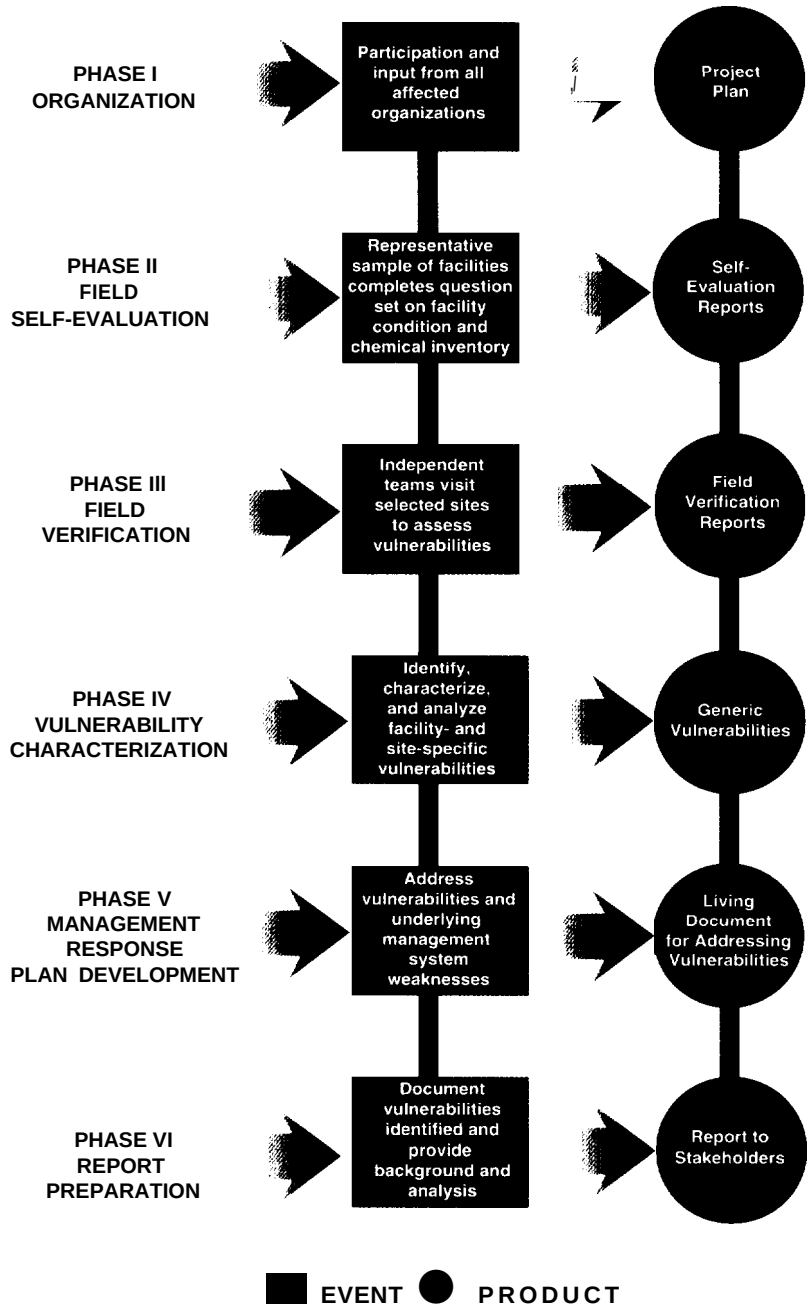

Figure 4. **Chemical Safety Vulnerability Review Process**

the potential vulnerability of individual facilities, including the age of the facility, changes in its mission and use, historically weak configuration management, and the accumulation of hazardous chemicals and wastes. Chemical safety issues associated with facility transition and D&D activities are not well defined and—in the absence of departmental action—will pose an increasing threat to the environment, the public, and worker health and safety. Dangers could result from construction-type activities (including D&D) because of the Department's limited experience with such activities in conjunction with chemical hazards that might be unrecognized, uncharacterized or unanalyzed.

Methodology

The initial meeting of the Chemical Safety Vulnerability Working Group was held March 1–2, 1994, to develop an approach and methodology for conducting the Chemical Safety Vulnerability Review. The methodology outlined in the project plan was based on sampling a range of DOE facilities and required the active involvement of DOE line management and contractor personnel having operational responsibilities. This approach was designed to ensure that the information provided was accurate, timely, and complete. As established in the project plan (provided in Appendix B), the Chemical Safety Vulnerability Review was designed to be conducted in six phases. (See Figure 4.)

Phase I-Organization

Phase I focused on developing a project plan, structure, and schedule that would permit completion of the Chemical Safety Vulnerability Review by July 29, 1994. During this phase, contact

was established with representatives of the Office of Environmental Management's (EM) Surplus Facility Inventory and Assessment Project and the Office of Defense Programs' Review of Organic-Oxidizer Vulnerabilities, thereby ensuring that the three related efforts were properly coordinated. (See Appendix P for more information on these initiatives.)

Phase II – Field Self-Evaluation

Phase II was designed to obtain information on chemical safety from a wide range of facilities and to encourage participation by DOE line organizations. Because the use of chemicals is widespread across the entire DOE complex, an evaluation of all facilities and sites was not possible within the timeframe provided for this review. Consequently, a sample of 84 facilities (e.g., laboratories, process facilities, waste locations, and storage areas) at 29 sites was selected for inclusion in the field self-evaluation process. The self-evaluation was also based on the types of chemical hazards known to exist at specific facilities. This process considered a number of factors, including the nature of the operation (e. g., production, laboratory, support, treatment, storage, or disposal); the status of the operation (e.g., ongoing, in transition, or D&D); and the types and quantities of chemicals involved.

The chemical contents of each facility included one or more of the following:

. hazardous chemical inventories potentially in excess of 25 percent of the threshold quantities defined by OSHA in 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals";

• chemical mixtures, byproducts, intermediate products, or other products generated as a result of process upsets involving hazardous substances defined by 29 CFR 1910.119;

. large numbers of hazardous chemicals in small quantities;

*** characterized hazardous waste or mixed waste; or**

*** wastes with unknown constituents.**

Selection of facilities for the field self-evaluation phase of the review was also aided by the results of the EM Surplus Facility Inventory and Assessment Project.

To ensure that the field self-evaluations were conducted consistently and to facilitate a comparison of results, a self-evaluation question set was developed by the Chemical Safety Vulnerability Working Group and was completed for each facility selected for review. (The question set is provided in Attachment 6 of Appendix B.) Field self-evaluations were performed by site contractors, reviewed by local DOE line management, and submitted to the Working Group.

Phase III - Field Verification

Phase III used independent teams of environmental, safety, and health (ES&H) professionals led by EH to confirm the accuracy and completeness of information provided as part of the field self-evaluations, to examine facility- and site-specific chemical safety vulnerabilities, and to assess the seriousness of the vulnerabilities identified. (See Appendix C.) Each team included members of the Working Group and was composed of 11 individuals, including a DOE team leader, ES&H professionals, a DOE site liaison, and administrative support professionals. The ES&H professionals included DOE and contractor personnel having expertise in chemical process systems, industrial hygiene, ES&H management systems, emergency management, facility maintenance, and environmental protection.

Nine large sites were selected to participate in the field verification phase of the review, based on the need to obtain a representative cross section of facilities, to conduct further investigations of selected facilities, and to clarify questionable data. The nine sites that hosted the 10-day field verification visits were Lawrence Livermore National Laboratory; Oak Ridge Reservation (including the K-25 Site, Oak Ridge National Laboratory, and Y-1 2 Plant); Savannah River Site; Hanford Site; Idaho National Engineering Laboratory; Rocky Flats Plant; Brookhaven National Laboratory; Los Alamos National Laboratory; and Sandia National Laboratories, New Mexico. (See Appendixes D through L, respectively.)

In addition, “mini-visits” (1 - or 2-day visits by teams of three ES&H professionals) were conducted at four small sites (i.e., fewer than 1,000 DOE and contractor employees) to provide supplementary information and to determine whether unique vulnerabilities existed at smaller sites. These four sites were the Energy Technology En-

gineering Center, West Valley Demonstration Project, Pittsburgh Energy Technology Center, and Naval Petroleum Reserves in California. (See Appendix M.)

The field verification visits addressed five functional areas, including identification of chemical holdings, facility physical condition, operational control and management systems, human resources programs, and emergency management programs. Each functional area was evaluated on the basis of standardized lines of inquiry provided in the "Field Verification Guide for the Chemical Safety Vulnerability Review;' dated April 8, 1994. (See Appendix C.) The Field Verification Guide and lines of inquiry ensured that a common approach to verification activities was used at each site. Self-evaluation data from Phase II of the review were verified by means of facility walkthroughs, interviews with management and technical personnel, examination of facility and site documentation, and review of incident reports and other documents.

The field verification teams visited 50 of the 84 facilities examined during Phase II and 64 facilities not previously examined, for a total of 114 facilities. The 64 additional facilities were selected to expand the range of facilities sampled and were examined against the technical criteria set forth in the Field Verification Guide. During the course of the review, a total of 148 facilities was evaluated (i.e., 84 examined by the sites during Phase II and 114 visited by the field verification teams during Phase Ill).

The field verification process resulted in the identification of 35 facility- and site-specific vulnerabilities. Local DOE and contractor personnel participated in all aspects of the field verification process and conducted factual accuracy reviews of draft field verification reports and their associated vulnerabilities. (See Table 2 for a list of all facilities visited during the field verification process.)

Phase IV - Vulnerability Characterization

Facility- and site-specific vulnerabilities were identified based on input from the field self-evaluations and observations by team members during field verification visits. Facility- and site-specific vulnerabilities were then prioritized in terms of the immediacy (immediate, short term, medium term, or long term) and severity (high, medium, or low) of their potential consequences. During the

Table 2. Facilities Visited During Field Verification Phase

SITE / FACILITY	CODE	INCLUDED IN SELF-EVALUATION	NOT INCLUDED IN SELF-EVALUATION
Savannah River Site			
412-D Heavy Water Extraction Facility	3	●	
H Area High-Level Waste Tank Farm	3	●	
241-96 H In-Tank Precipitation Facility	3	●	
299-H High-Level Waste Maintenance Facility	3	●	
F Area Concentrate Transfer System	9	●	
L Reactor	10		●
P Reactor	10		●
184-P Power House	11		●
315-M Essential Materials Storage			●
316-M Mixed-Waste Storage Shed	:		●
320-M Analytical Laboratory	1		●
483-D Chlorination Facility	8		●
717-9 P Excess Chemical Facility	5		●
Oak Ridge Reservation			
K-25 Sits			
Ponds Waste Management Project	7	●	
Lithium Storage Vaults, Building K-25	6	●	
Contaminated Burial Ground K-107 O-A	11	●	
K-25 Process Building	10		●
K-725 Beryllium Building	10		●
K-1 066 Storage Yards	5		●
Y-12 Plant			
Budding 9201-4, Hazardous Materials Bulk Storage	5		
Building 9720-5, Compressed Gas Storage, Main Warehouse	5		
Building 1405, Johnson Control World Services Building	8		●
Building 9201-5, Alpha-5	4,5		●
Building 9202, R&D Laboratory	1		●
Oak Ridge National Laboratory			
Hazardous Waste Site (Emergency Waste Pond, 7821; Chemical Waste Evaporator Building. 3506: and Contractor Landfill 7658)	6		
Building 3047, Radioisotope Separation Facility	4		●
Lawrence Livermore National Laboratory			
Buildings 825-827, Chemical Processing Facility Complex	2	●	
Budding 235, Chemical and Materials Sciences Facility	1	●	
Buildings 222-229, Research and Development Laboratory Complex for Explosives	4	●	
Building 153, Electronics Engineering Micro-Fabrication Facility	3		●
Building 322, Metals Finishing Faclity	3		●
Fire Station No. 2 (City of Livermore)	NA		●
Rocky Flats Plant			
Building 551, General Warehouse	3	●	
Building 559, Plutonium Analytical Laboratory	1	●	
Building 371, Plutonium Recovery Facility	1,6	●	
Building 881, General Laboratory and Central Computing	7	●	
Building 207, Industrial Waste Holding Tank	10	●	
Building 374, Waste Treatment	4.7		●

Facility codes are defined as follows:

1 = Operating or shutdown laboratory
2= Operating or shutdown pilot plant
3= Operating process facility
4 = Shutdown or standby process facility
5= Operating chemical storage faciliy
6 = Operating waste storage/disposal facility
7 = Shutdown waste storage/disposal facility
8 = Operating utility
9 = Shutdown EM facility
10 = Transition facility
11 = Abandoned facility

Table 2 (continued). Facilities Visited During Field Verification Phase

SITE	FACILITY	CODE	INCLUDED IN SELF-EVALUATION	NOT INCLUDED IN SELF-EVALUATION
Hanford Site				
	Building 2703E, Chemical Engineering Laboratory	2	●	
	Building 234-52, Plutonium Finishing Plant	4	●	
	Budding 202A, PUREX Plant	4	●	
	Budding 324, High Bay Engineering Laboratory	2	●	
	Building 331, Life Sciences Laboratory	1	●	
	Building 3718G, Warehouse	5		●
	Building 283E, Water Treatment Plant	6,8		●
	Building 616, RCRA Hazardous Waste Storage Facility	6		●
	Building 305B, RCRA Hazardous Waste Storage Facility	6		●
Idaho National Engineering Laboratory				
	Buildings 601, 602, and 621, Fuel Processing Facility	4	●	
	Tank Farm	6	●	
	Waste Storage Pad A and Waste Disposal Pit 9 at the Radioactive Waste Management Complex	7	●	
	Army Reentry Vehicle Facility Site Sodium-Potassium Storage Unit	10	●	
	Power Burst Facility Reactor Area Evaporation Pond	11	●	
	ANL-W Analytical Laboratory	11	●	
	Fluorinel Dissolution Process& Fuel Storage Facility	4		●
	Waste Calcining Facility	4		●
	Rover Headend Process Plant	4		●
	Radioactive Sodium Storage Facility	5		●
	Radioactive Scrap & Waste Facility	6		●
Sandia National Laboratories, New Mexico				
	Building 858, Microelectronics Development Facility	3	●	
	Buildings 805, 806, and 807, Laboratory Facilities	1	●	
	Build/rig 878, Advanced Manufacturing Process Laboratory	3	●	
	Building 958, Hazardous Waste Management Facility	6	●	
	Light Initiated Explosive Test Facility	1	●	
	Building 8526, Large Centrifuge Facility			●
	Building 6587, Facility Operation and Maintenance	5,:		●
	Lurance Canyon Burn Site	1		
	Thunder Range Explosive Facility			✚
	Chemical Waste Landfill	:		●
	KAFB Fire Department	NA		●
	Building 893, Compound Semiconductor Research Laboratory	1		●
	Building 983, Particle Beam Fusion Accelerator II	1		●
Los Alamos National Laboratory				
	TA-3-1 70, Gas Cylinder Distribution Plant	5	●	
	TA-33-86, Tritium High Pressure Lab	4	●	
	TA-54, Waste Storage Facilities	6	●	
	TA-1 6-0342, S-Site Explosives Blending Facility	1,3	●	
	TA-3-29, Chemical and Metallurgy Research Facility	3,4	●	
	TA-3, Building SM-30, General Warehouse	5		●
	TA-3, Building SM-31, Chemical Warehouse			●
	TA-46, Wastewater Treatment Facilities	6,:		●
	TA-54, Building 1008, Chlorination Station	8		●

Table 2 (continued). Facilities Visited During Field Verification Phase

SITE	FACILITY	CODE	INCLUDED IN SELF-EVALUATION	NOT INCLUDED IN SELF-EVALUATION
Brookhaven National Laboratoy				
	Hazardous Waste Management Facility	6	●	
	Wastewater Treatment Facility	8	●	
	Personnel Decontamination Facility Tank 490-07	11	●	
	Tandem Van de Graaff Accelerator			●
	Central Water Treatment Facility	:		●
Energy Technology Engineering Center				
	Kalina Demonstration Plant	2	●	
	Sodium Storage Building	5	●	
	Sodium Component Test Installation	2		●
	Cleaning and Handling Facility	3		●
	Hazardous Waste Treatment Facility	6		●
	Chemistry Laboratory	1		●
	Sodium Pump Test Facility	2		●
Naval Petroleum Reserves in California				
	35R Complex	3	●	
	Loading Rack	5		●
	Storage Area	5		●
	Laboratory	1		●
	Lab Chemical Storage Building	5		●
	Lean Oil Absorption Plant	3		●
	Low Temp Separation Unit No. 1	3		●
	Hazardous Waste Temporary Storage Pad	6		●
	Compressed Gas Storage Warehouse	5		●
Pittsburgh Energy Technology Center				
	Building 74, Wastewater Treatment Facility	8	●	
	Buildlng 64, Chemical Handling Facility	5		●
	Building 65, Gas Cylinder Storage	5		●
	Building 83, Liquefaction Facility	2		●
	Building 84, Chemical Engineering Lab	1		●
	Building 92, Chemical Handling Facility	1		●
	Building 93, Combustion Test Facility	2		●
	Building 94, Analytical Chemistry Lab	1		●
	Building 99, Cylinder Gas Distribution System	8		●
	Building 141, Coal Preparation Facility	2		●
West Valley Demonstration Project				
	Hazardous Waste Storage Area Locker	6	●	
	Analytical Environmental Lab	1	●	
	Supernate Treatment System	3	●	

Facility codes are defined as follows:

1 = Operating or shutdown laboratory
2 = Operating or shutdown pilot **plant**
3 = Operating process facility
4 = Shutdown or standy process facility
5 = Operating chemical storage facility
6 = Operating waste storage/disposal facility
7 = Shutdown waste storage/disposal facility
8 = Operating utility
9 = Shutdown EM facility
10 = Transition facility
11 = Abandoned facility

course of the nine field verification visits, 35 facility- and site-specific chemical safety vulnerabilities were characterized. (See Appendixes D through L.)

On completion of Phase Ill, the Working Group met to evaluate information gathered during the review to identify generic chemical safety vulnerabilities (i.e., vulnerabilities potentially having broad application to the DOE complex). Information considered included data from the field self-evaluation effort, vulnerabilities identified at sites visited by the field verification teams, observations from mini-visits to smaller DOE sites, data from the Occurrence Reporting and Processing System, and information provided by the EM Surplus Facility Inventory and Assessment Project. Generic vulnerabilities were developed by reviewing the sources of information noted above and organizing these data around common issues and circumstances. This “generalization” process resulted in the identification of eight generic vulnerabilities, each of which was supported by many specific examples observed at DOE sites. These generic vulnerabilities are believed to be representative of vulnerabilities at other sites across the DOE complex. Specifically, the circumstances or conditions that gave rise to the generic vulnerabilities exist elsewhere; the types and quantities of chemicals used at other sites are comparable; the processes or operations performed are common to multiple sites; or the management practices by other sites for chemical safety are comparable. During this process, four underlying management system weaknesses that contributed to the presence of the generic vulnerabilities were also identified.

Phase V – Management Response Plan Development

Phase V involved identification of actions to eliminate or mitigate the potential consequences of chemical safety vulnerabilities. Responsibility for preparing management response plans for facility- and site-specific vulnerabilities was assigned to DOE field organizations (e.g., operations offices, area offices, site offices), as appropriate. Management response actions are being developed and incorporated into existing site corrective action programs for all facility- and site-specific vulnerabilities. Local DOE line management organizations will approve site management response plans and track the effectiveness of proposed responses using existing management systems.

The management response plan for addressing generic vulnerabilities was prepared by the Chemical Safety Vulnerability Working Group and was coordinated with responsible program offices and field organizations. This plan includes actions that should be implemented immediately, as well as those that should be implemented over a 3–5-year timeframe, to address programs, funding, and policy decisions for the Department as a whole. In developing this overall management response plan, the Working Group considered recommendations and suggestions included in site-specific management response plans.

The management response plan was developed as a separate document to allow modifications and updates, as appropriate. Key management factors considered while the plan was being developed included (1) a DOE commitment to improve the efficiency of its directives system, (2) reliance on performance-based contracting, (3) emphasis on the principles of "total quality management," (4) recognition of budget limitations, (5) realistic appreciation of chemical safety expertise within DOE organizations, and (6) a commitment to build on existing departmental initiatives related to chemical safety.

Phase VI - Report Preparation

Phase VI was completed by a designated subgroup of the Chemical Safety Vulnerability Working Group after completion of Phases Ill and IV above. Drafts of the report were provided to DOE program and field offices for factual accuracy review.

Report Organization

Volume 1 of this report summarizes the results of the Chemical Safety Vulnerability Review, with key information provided in four chapters entitled "Summary of Vulnerabilities:' "Management System Weaknesses:' "Commendable Practices:' and "Summary of Management Response Plan." A series of conclusions presented in a fifth chapter summarizes the significant findings of the review. A glossary of chemical terms used in this report is provided at the end of Volume 1. Volumes 2 and 3 contain 18 appendixes. Table 3 describes and summarizes the information in each appendix.

Table 3. **Summary of Appendixes**

APPENDIX	DESCRIPTION	CONTENT
A	Tasking Memorandums	Memorandums From Secretary of Energy and From Assistant Secretary for Environment, Safety and Health Establishing the Chemical Safety Vulnerability Review and Providing Overall Guidance
B	Project Plan	Scope, Project Approach, Project Schedule, Sites and Facilities Examined, Vulnerability Prioritization Criteria, List of Working Group Members
C	Field Verification Guide	Verification Methodology, Team Adminitration, Lines of Inquiry, Team Members' Areas of Responsibilities, Daily Schedules for Field Verification Visits
D	Lawrence Livermore National Laboratory Field Verification Report	Vulnerabilities, Commendable Practices, Summary of Results, and Team Composition
E	Oak Ridge Reservation Field Verification Report	Vulnerabilities, Commendable Practices, Summary of Results, and Team Composition
F	Savannah River Site Field Verification Report	Vulnerabilities, Commendable Practices, Summary of Results, and Team Composition
G	Hanford Site Field Verification Report	Vulnerabilities, Commendable Practices, Summary of Results, and Team Composition
H	Idaho National Engineering Laboratory Field Verification Report	Vulnerabilities, Commendable Practices, Summary of Results, and Team Composition
I	Rocky Flats Plant Field Verification Report	Vulnerabillties, Commendable Practices, Summary of Results, and Team Composition
J	Brookhaven National Laboratory Field Verification Report	Vulnerabilities, Commendable Practices, Summary of Results, and Team Composition
K	Los Alamos National Laboratory Field Verification Report	Vulnerabilities, Commendable Practices, Summary of Results, and Team Composition
L	Sandia National Laboratories, New Mexico, Field Verification Report	Vulnerabilities, Commendable Practices, Summary of Results, and Team Composition
M	Mini-Vlslts to Small DOE Sites	Summary of Field Verification Mini-Visits to Energy Technology Engineering Center, Naval Petroleum Reserves in California, Pittsburgh Energy Technology Center, and West Valley Demonstration Project
N	Working Group Meeting, June 7-8, 1994	Agendas, Participant List for June 7–8, 1994, Working Group Meeting
O	Commendable Practices	Descriptions of Commendable Practices and Points of Contact
P	Related Chemical Safety Initiatives at DOE	Surplus Facility Inventory and Assessment Project and Defense Programs' Tomsk-7 Review
Q	Regulatory Framework and Industry Initiatives Concerning Chemical Safety	Description of Regulations Governing Chemical Safety Activities and Industry Initiates Regarding Chemical Safety
R	Chemical Inventory Data From Field Self-Evaluation Report s	List of Reported Quantities of Selected Hazardous Chemicals From Field Self-Evaluation Reports