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DOE HANDBOOK

CHEMICAL MANAGEMENT
(Volume 2 of 2)

U.S. Department of Energy
Washington, D.C. 20585

AREA SAFT

Foreword

This non-mandatory Handbook is designed to assist Department of Energy (DOE) and contractor managers in assessing chemical hazard management and is approved for use by all DOE Components and their contractors. Examples of best practices and real life examples needed to institute high-quality chemical management within the context of a site's Integrated Safety Management System (ISMS) are provided.

DOE Policy 450.4, "Safety Management System Policy," and Chapter 9 of Title 48 of the Code of Federal Regulations (CFR), Department of Energy Acquisition Regulation (DEAR), call for systematic integration of safety into management and work practice at all facets of work planning and execution. Material acquisition, handling, and final disposition are some of the key elements of management systems to which the Integrated Safety Management (ISM) Core Functions are applied. Consideration of environment, safety, and health risks for these elements is, in principle, the same for all hazards, whether chemical, radiological, or physical. Therefore, a quality chemical management program is merely part of a site's ISMS and need not call for new or additional requirements.

This Handbook consists of two volumes. Volume 1 contains the core material, including a discussion of the elements of a quality chemical program and information on applicable DOE, Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) directives, standards, and requirements. The appendices to Volume 1 contain sample lines of inquiry, which may be used for ISM verification; lessons learned to allow readers an opportunity to learn from the experiences of their peers; and a listing of program resources.

Volume 2 supplements the core Handbook. This volume presents site approaches to chemical management programs from across the DOE complex and the chemical industry to illustrate chemical management program implementation. In some cases these samples have been reformatted to reflect the organization in Volume 1, making it easier to find specific information.

The Handbook is designed to serve as a general reference for chemical management. It is formatted to allow quick and easy access to its content and useful references. For example, the oversized left margin contains annotations to key points presented in the text. In addition, in the electronic version, these annotations are active links which allow navigation to web sites for more detailed information on specific topics. An expanded version of this document with the most recent collection of best practices and lessons learned will be maintained on the DOE Chemical Management Web Site at http://www.eh.doe.gov/web/chem_safety/.

We invite everyone to share their experiences by submitting good chemical management practices or lessons learned via our Web Site Feedback page at http://www.eh.doe.gov/web/chem_safety/. In addition, beneficial comments on this Handbook (recommendations, additions, deletions) and any pertinent data that may improve this document should be sent to: Director, DOE Office of Worker Health and Safety (EH-5), U.S. Department of Energy, Washington, D.C. 20585, by letter or by sending the self-addressed Document Improvement Proposal Form (DOE F 1300.3), available at http://www.explorer.doe.gov:1776/pdfs/forms/1300-3.pdf

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GLOSSARY

The following definitions are based on existing DOE directives:

Authorization Basis—Safety documentation supporting the decision to allow a process or facility to operate. Included are corporate operational and environmental requirements as found in regulations and specific permits, and, for specific activities, work packages or job safety analyses.

Contractor—Any person under contract (including subcontractors or suppliers) with DOE with the responsibility to perform activities or supply services or products.

Enhanced Work Planning—A process that evaluates and improves the program by which work is identified, planned, approved, controlled, and executed. The key elements of enhanced work planning are line management ownership; a graded approach to work management based on risk and complexity; worker involvement beginning at the earliest phases of work management; organizationally diverse teams; and organized, institutionalized communication.

Environmental Management System—That part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy.

Facility—The buildings, utilities, structures, and other land improvements associated with an operation or service and dedicated to a common function.

Hazard—A source of danger (i.e., material, energy source, or operation) with the potential to cause illness, injury, or death to personnel or damage to a facility or to the environment (without regard to the likelihood or credibility of accident scenarios or consequence mitigation).

Hazard Analysis—The determination of material, system, process, and plant characteristics that can produce undesirable consequences, followed by the assessment of hazardous situations associated with a process or activity. Largely qualitative techniques are used to pinpoint weaknesses in design or operation of the facility that could lead to accidents. The Safety Analysis Report (SAR) hazard analysis examines the complete spectrum of potential accidents that could expose members of the public, on-site workers, facility workers, and the environment to hazardous materials.

Hazard Controls—Design features; operating limits; and administrative or safety practices, processes, or procedures to prevent, control, or mitigate hazards.

Integrated Safety Management Core Functions—The core safety management functions for DOE P 450.4, "Safety Management System Policy," which are to: (1) define the scope of work; (2) analyze the hazards; (3) develop and implement hazard controls; (4) perform work within controls; and (5) provide feedback and continuous improvement. These functions are also identified in DEAR 48 CFR 970.5204-2(c).

Integrated Safety Management System—A Safety Management System to systematically integrate safety into management and work practices at all levels as required by DOE P 450.4, "Safety Management System Policy," and the other related Policies: DOE P 450.5 and DOE P 450.6.

Occurrence Report—A documented evaluation of an event or condition that is prepared in sufficient detail to enable the reader to assess its significance, consequences, or implications and to evaluate the actions being proposed or employed to correct the condition or to avoid recurrence.

Performance Indicator—Operational information indicative of the performance or condition of a facility, group of facilities, or site.

Pollution Prevention—The use of materials, processes, and practices that reduce or eliminate the generation and release of pollutants, contaminants, hazardous substances, and waste into land, water, and air. For DOE, this includes recycling activities.

Risk—The quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

Safety Analysis—A documented process to (1) provide systematic identification of hazards within a given DOE operation; (2) describe and analyze the adequacy of the measures taken to eliminate, control, or mitigate identified hazards; and (3) analyze and evaluate potential accidents and their associated risks.

Voluntary Protection Program—The Department of Energy Voluntary Protection Program (DOE-VPP), which promotes safety and health excellence through cooperative efforts among labor, management, and government at DOE contractor sites. DOE has also formed partnerships with other

Federal agencies and the private sector for both advancing and sharing its Voluntary Protection Program (VPP) experiences and preparing for program challenges in the next century. The safety and health of contractor and federal employees are a high priority for the Department.

Work Planning—The process of planning a defined task or activity. Addressing safety as an integral part of work planning includes execution of the safety-related functions in preparation for performance of a scope of work. These functions include: (1) definition of the scope of work; (2) formal analysis of the hazards bringing to bear in an integrated manner specialists in both environment, safety and health (ES&H) and engineering, depending on specific hazards identified; (3) identification of resulting safety controls including safety structures, systems, and components, and other safety-related commitments to address the hazards; and (4) approval of the safety controls.

Work Smart Standards Process—The Work Smart Standards (WSS) process is used to reach agreement between DOE and its contractors with regard to the applicable standards to be followed for safe work. WSS was approved for use in January 1996 and issued as policy in DOE P 450.3, "Authorizing the Use of Necessary and Sufficient for Standards-Based Environmental, Safety and Health Management." The process for applying the WSS is described in DOE M 450.3-1, "The Department of Energy Closure Process for Necessary and Sufficient Sets of Standards."

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Acronyms and Abbreviations

ACC	American Chemistry Council
ACGIH	American Conference of Governmental Industrial Hygienists
ACIS	Automated Chemical Inventory System
ARAC	Atmospheric Release Advisory Capability
ASA	Auditable Safety Analysis
ATSDR	Agency for Toxic Substances and Disease Registry
BHI	Bechtel Hanford Incorporated
BIO	Basis for Interim Operation
BNL	Brookhaven National Laboratory
CAMEO	Computer-Aided Management of Emergency Operations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGITS	Cradle-to-Grave Information and Tracking System
CHEMTREC	Chemical Transportation Emergency Center
CO2	Carbon Dioxide
CSTC	Chemical Safety Topical Committee
DEAR	Department of Energy Acquisition Regulation
DOE	Department of Energy
DOE-VPP	Department of Energy Voluntary Protection Program
DOT	Department of Transportation
EA	Environmental Assessment
EH-5	DOE Office of Worker Health and Safety
EIS	Environmental Impact Statement
EM	DOE Office of Environmental Management
EM&R	Emergency Management and Response
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ES&H	Environment, Safety and Health
EWP	Enhanced Work Planning
FEMA	Federal Emergency Management Agency
FEMIS	Federal Emergency Management Information System
HASP	Health and Safety Plan
HAZMAT	Hazardous Materials

HEPA	High Efficiency Particulate Air
HF	Hydrogen Fluoride
HMIS	Hazardous Materials Information System
HAZWOPER	Hazardous Waste Operations and Emergency Response
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
ISO	International Organization for Standardization
LDR	Land Disposal Restriction
LOI	Lines of Inquiry
MARPLOT	Mapping Applications for Response and Planning of Local Operational Tasks
MIN	Materials In Inventory
MSDS	Material Safety Data Sheet
MSV	Management System Verification
NaK	Sodium Potassium
NEPA	National Environmental Policy Act
NETO	National Environmental Training Office
NIOSH	National Institute for Occupational Safety and Health
NSC	National Safety Council
OE	Operating Experience
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PFP	Plutonium Finishing Plant
PNNL	Pacific Northwest National Laboratory
RCRA	Resource Conservation and Recovery Act
RMP	Risk Management Plan
RQ	Reportable Quantity
SAR	Safety Analysis Report
SARA	Superfund Amendments and Reauthorization Act
SBMS	Standards-Based Management System
SLG	State and Local Guide
SME	Subject Matter Expert
SNL	Sandia National Laboratory
S/RIDs	Standards/Requirements Identification Documents

SRS	Savannah River Site
SSC	System, Structure, or Component
TLV	Threshold Limit Value
TQ	Threshold Quantity
VPP	Voluntary Protection Program
WSS	Work Smart Standards

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INTRODUCTION AND SCOPE

Volume 2 presents a description of the chemical management practices as individually developed at several Department of Energy (DOE) facilities. These are formatted according to the order presented in Volume 1 of the Handbook, published by the Chemical Safety Topical Committee (CSTC) in November 2000. Electronic inventory tracking, automated Material Safety Data Sheet (MSDS) systems, and Hazard Communication training are common among all Sites. Pantex, because of their explosive manufacturing processes, uses the analysis dictated by the OSHA Process Safety Management Standard more than most sites.

The CSTC, a topical committee sponsored by the DOE and the Energy Federal Contractors Group (EFCOG) Chemical Safety Subgroup, recognized the need for a Chemical Management Handbook during a joint DOE – EFCOG Chemical Management Workshop. A working group composed of both DOE and contractor members developed the Handbook. During the early stages of development the working group decided to separate the Handbook into two volumes — the first being a discussion of the principles of chemical management; the second, a collection of chemical management practices in use across DOE. Chemical management is only one part of an Integrated Safety Management system. Sites have voluntarily submitted their chemical management plans for inclusion. None of these examples should be interpreted as either a comprehensive Chemical Management Program (CMP) or the most current CMP. Readers are encouraged to contact the relevant DOE site for the latest CMP.

Volume 2 is meant to be a living document (i.e., additional and modified practices can be added to this document). As with Volume 1, this document and any revisions will be posted on the Office of Environment, Safety and Health (EH) Chemical Management Web Site at

http://www.eh.doe.gov/web/chem_safety/

Due to the temporal nature of printed documents the reader should refer to the Web site to obtain the latest version of this information.

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Argonne National Laboratory Chemical Management Program

1.0 Introduction and Scope

The Argonne National Laboratory (ANL) Chemical Management System (CMS) electronically integrates chemical tracking, procurement, and Material Safety Data Sheets (MSDS). ANL implemented its CMS in 1992 to address the need for an enterprise solution to track tens of thousands of chemicals and MSDSs. In 1999, the CMS was expanded to include chemicals from ANL-West in Idaho Falls.

2.0 Chemical Life-cycle Program

ANL's CMS has two key modules: the MSDS System and the Chemical Tracking System (CTS). The MSDS system enables rapid search and location of an MSDS, specific information retrieval from the MSDS, or delivery of the entire MSDS. Linkage of each chemical record with the corresponding MSDS allows immediate retrieval of ingredient, Chemical Abstract Service (CAS) number, and hazard information.

Over 33,000 scanned MSDS images are available for viewing, printing, or faxing. New chemical purchases are captured through electronic interfaces with Procurement Systems. Chemicals are assigned bar-codes at the receiving dock, and inventory records are created to streamline chemical ordering and record keeping. The CTS maintains inventory records for over 110,000 bar-coded chemicals, including location and ownership information.

The CMS facilitates compliance with environment, safety, and health (ES&H) regulations and provides a tool for maintaining safe working environments. Reports from the system identify which chemicals are carcinogens or date-sensitive and provide data for completion of Environmental Protection Agency (EPA) TRI and SARA reports.

Other system features include satellite waste area records, bulk chemical tracking, gas cylinder inventory, and a surplus chemical bulletin board for waste minimization. MSDS searching, viewing, and printing is available on the Laboratory's Intranet. In addition, a laptop computer program with integrated bar-code scanning was developed to facilitate initial and periodic re-inventory and material reconciliation.

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Idaho National Engineering and Environmental Laboratory Chemical Management Program

1.0 Introduction and Scope

The Idaho National Engineering and Environmental Laboratory (INEEL) developed a chemical management program that integrates requirements, procedures, tools and an Integrated Safety Management System (ISMS) into one system. This program is used to track and control chemicals throughout their life cycle through the use of the INEEL Chemical Management System (ICMS) database. There is also an integrated ESH review (via an Agent/Chemical Request and Evaluation, 442 Form) which is used to initiate ICMS records, as well as ensure facility personnel are aware of new chemical being acquired and stored in their facilities.

2.0 Chemical Life-cycle Program

2.1 Hazard Identification and Analysis

The Chemical Data Summary Sheet (CDSS) is a part of a larger INEEL Chemical Management System (ICMS) — a computerized tracking system for chemical products, chemicals, or hazardous agents (CPCHA). INEEL developed the CDSS as a tool to aid in hazard identification. Chemical safety experts evaluated every CPCHA at INEEL and developed a CDSS for each. Information on the CDSS includes the National Fire Protection Association (NFPA) diamond; a listing of all hazards; and a compatibility classification, time-sensitive classification, and building code classification for the identified CPCHA. While the CDSS is not a replacement for an MSDS, it does contain site-specific safety information that cannot be found in an MSDS and that information is presented in a standardized format

When planned work involves CPCHAs, the MSDSs and CDSSs for these CPCHAs are gathered. A checklist is used to perform a preliminary analysis to determine (1) the severity of the work that will be performed, (2) the level of analysis that needs to be conducted, and (3) the personnel who need to be involved in the analysis process.

During the hazard analysis process, hazards are evaluated and mitigation is determined. Walkdowns of the work area are performed as necessary, and the final safety documentation (e.g., safe work permits) is generated. Employees are trained on the hazards present including the hazards of general classes of materials, and hazard mitigation is identified, along with hazard controls. Work is then performed within those controls. If an unexpected event occurs during the work process, the work is stopped and is not restarted until sufficient analysis is performed to determine how work can safely be resumed. Upon completion of the work, particularly in the operations area, a post-job briefing is held to provide feedback and to determine any improvements.

2.2 Chemical Acquisition

A series of reviews are performed before procuring a CPCHA. The first review determines whether the requestor has used that CPCHA before for the same purpose. If the requestor has used the CPCHA previously and for the same purpose, no further review is required and the acquisition request can

proceed. Otherwise, the requester must complete a 442 form (Agent/Chemical Request and Evaluation Form) and submit it along with an MSDS for the CPCHA.

Not only does the 442 form establish an acquisition process for a first time purchase of a CPCHA, it facilitates two other processes. First, it provides accurate and complete information about the CPCHA that can be entered into the ICMS prior to the acquisition. The Chemical Management Services staff also uses the form to review the CPCHA, populate information fields in the ICMS, and develop a CDSS for the CPCHA. Secondly, the request is reviewed by facility environmental and safety personnel, to insure facility involvement. When all reviews are complete, the CPCHA is procured.

2.3 Chemical Inventory and Tracking

Barcode numbers are used to track chemicals from the time they arrive at the INEEL to disposition. The barcode numbers are tracked in the INEEL oracle-based database (the ICMS). The ICMS provides inventory tracking as well as safety information, such as hazards of the CPCHA, storage classification information (to ensure chemicals are stored compatibly), and carcinogen information. The ICMS is linked to an electronic data base containing INEEL MSDSs. In addition, the ICMS can generate reports to support ES&H, emergency response, and facility operations; provides a hazardous agent inventory information to support industrial hygiene activities, and electronically generates data used for Federal and state mandated reports.

2.4 Transportation

INEEL is a reservation approximately the size of Rhode Island, located 50 miles west of Idaho Falls, Idaho. There are numerous facilities located around the site on the desert, as well as research facilities in Idaho Falls. When CPCHA movement between facilities occurs over public highways, Department of Transportation (DOT) regulations are followed. INEEL maintains an organization that is specifically tasked with transporting materials according to DOT regulations.

2.5 Storage

Because of the large number of requirements associated with CPCHA storage, INEEL uses one document to consolidate all storage requirements. This document is tied to a requirements-management database to ensure complete coverage and traceability of all requirements. Proper implementation also requires developing additional procedures for (1) compatible storage of CPCHAs (2) management of time-sensitive CPCHAs, and (3) adherence to facility storage limits.

The INEEL program that ensures compatible storage of chemicals involves a procedure that describes how to identify proper storage areas (i.e., a storage area constructed of materials compatible with the item to be stored) and details a compatibility scheme based on color designations. Employees use the CDSS to determine what the compatibility classification is for a specific CPCHA and whether there are any special storage requirements (e.g., refrigeration, keeping under an inert atmosphere).

INEEL also developed a program to manage time-sensitive chemicals that involves use of a procedure and the CDSS. The procedure directs the employee to the CDSS to determine whether the CPCHA is a time-sensitive material and, if so, its class. The procedure then describes how the employee should manage time-sensitive chemicals, inspect expired containers, and test the CPCHA to determine if it is hazardous. The procedure also provides specific criteria for determining whether the CPCHA is hazardous.

INEEL's program for ensuring that facilities maintain chemical inventories that are below limits placed upon them by the Uniform Building Code and Uniform Fire Code, consists of the ICMS, the CDSS, and a procedure. Every CPCHA at INEEL has been characterized as to its building code classification, and that information has been entered into the CDSS and the ICMS. Facility reports are available through the ICMS to help determine whether chemical inventories are approaching the facility limits.

2.6 Control of Chemical Hazards

INEEL controls chemical hazards at the activity level. Each CPCHA is reviewed to determine if a less hazardous substitute can be used without negatively impacting the work or safety. CPCHAs are also reviewed to determine if any controls need to be put into place. For example, barriers (such as glove boxes, fume hoods, and remote operation), monitoring, personnel protective equipment (PPE), and similar controls may be required to protect the employee, facility, or environment. During these reviews, factors such as other CPCHAs and other materials in the work area that may interact with CPCHAs that will be used during a work activity are evaluated. Processes exist for both operations and R&D for employees tp know hazards and how mitigation occurs. They can also go to the CDSS to determine what the proper secondary container label would be for any CPCHAs they are using. Employees are informed of signs and symptoms of exposures, and, in the event of an exposure, the employee enters a medical surveillance program.

2.7 Pollution Prevention and Waste Minimization

Several programs are in place to address pollution prevention and waste minimization. The INEEL recycles a variety of materials through subcontracts, donations, and as excess material available to the public. Subcontracts reclaim useful portions of products prior to disposal or residual material. The INEEL's Pollution Prevention (P2) Program has been strategically positioned in the Waste Generator Services group, which facilitates integration in other equally important and programs such as ISO 14001, RCRA, and other associated disciplines. Te P2 Program is made up of five major elements: Solid Waste Management, which identifies recycling opportunities and develops supporting subcontracts to facilitate waste reduction and the Material Exchange Program; P2 Integration, which includes Pollution Prevention in Design, Affirmative Procurement, and ISO 14001; Planning and Reporting Program; Waste Reduction, which assists generators in conduction Pollution Prevention Opportunity Assessments to identify P2 opportunities in their work processes; and Training and Awareness.

The INEEL Affirmative Procurement Program encourages purchasing products with a recycled content material whenever possible. This program won the 2000 National Pollution Prevention Award for Affirmative Procurement and the White House Closing the Circle Award.

2.8 Emergency Management

An emergency management organization is tasked with planning for potential emergencies. This organization is responsible for ensuring that adequate resources are available, that appropriate notification processes are in place, that adequate memorandums of understanding are in place with neighboring local governments and agencies, and that the INEEL hazardous materials response team is adequately trained and prepared. A major concern of this organization is the potential for a chemical accident. To help with their planning and response activities, the emergency management organization maintains an interface with ICMS so that they have a real-time knowledge of what CPCHAs are present at what facility and in what quantities. During an emergency, they can access ICMS to determine what is present and plan the response accordingly. Exercises to test their ability to respond are held several times a year.

2.9 Disposal

Waste Generator Services (WGS) is tasked with knowing all regulations concerning waste, its storage, and its disposal. Users contact WGS when a CPCHA becomes a wasste or when they declare the CPCHA a waste. When WGS dispositions CPCHAs, a waste technical specialist inputs the characterization data into the Integrated Wastes Tracking System (IWTS) database, which tracks the waste to a disposal path. WGS also notifies the ICMS chemical custodian when the CPCHA has been sent off site for final disposition, so the ICMS database can be updated to reflect disposition."

2.10 Training

Training for employees occurs at several levels at the INEEL. Employees who work in the laboratory receive chemical hygiene training; all other employees receive hazard communication training. In addition, employees receive facility-specific training concerning those hazards associated with the facility within which they work and are trained on those hazards associated with their work. This training includes what hazards are present, what mitigating actions have been taken to protect the employee, signs and symptoms of exposure, and what to do in an emergency. Employees are also trained in ISMS and how to stop work should they discover an unsafe or unforeseen situation.

Los Alamos National Laboratory Chemical Management Program

1.0 Introduction and Scope

Chemical safety management at the Los Alamos National Laboratory (LANL) is addressed through the Chemical Management Laboratory Implementation Requirements (LIR 402-510-01.0) and is implemented under Integrated Safety Management (ISM) by the Division Directors and Group Offices. The Chemical Management LIR defines the LANL Chemical Management Program implemented to protect worker health and safety, prevent pollution, assist emergency management and response, protect the environment, and minimize waste by controlling chemical activities. This document applies to all work areas in which chemicals are manufactured, machined, handled, received, distributed, transported, used, or stored. Activities covered by the LIR include maintenance, construction, research and development, environmental restoration, and decontamination and decommissioning of LANL facilities and equipment that involve the use of chemicals or the existence of chemical residues.

2.0 Chemical Life-cycle Program

The ES&H Division maintains LANL's Automated Chemical Inventory System (ACIS). Only those personnel authorized by their supervisor, who are knowledgeable of the effects of hazardous chemicals, can procure and receive chemicals. All chemical containers must have an "owner," and this owner must be a qualified chemical worker. Individuals with appointments of less than 1 year, visitors, undergraduate, and high school students may not be chemical owners. The immediate supervisor for the latter classifications of workers is the chemical owner.

LANL maintains a chemical inventory on the ACIS, which is a Laboratory-wide chemical inventory system. LANL's explosive and special nuclear material inventories are maintained on separate inventory systems for security reasons. Water, sand, saline solutions, chemicals of biological origin (DNA, RNA, immunochemicals, antibodies, enzymes, peptides), and office supplies (e.g., whiteout, toner, marker board cleaner, ink) are not tracked in ACIS. If a component of a consumer product is regulated, makes the product or container a hazardous waste, poses a health or physical hazard to workers (i.e., 1 percent hazardous chemical or 0.1 percent carcinogen, or the contents are stored under high pressure), it is tracked in the ACIS. Consumer products are tracked in ACIS when the product is used differently from the normal consumer use or is used in greater quantities or concentration than by the general public. As bar-coded containers are emptied, they are marked as "disposed" in ACIS. When a container is disposed, any remaining chemical becomes waste.

The ES&H Division maintains a web site where MSDSs are available for review for HazCom (Hazard Communication Program) and chemical hygiene plans. MSDS data are collected to satisfy EPCRA reporting requirements and to complete waste disposal forms. All chemical disposals are performed in accordance with General Waste Management Requirements (LIR 404-00-02.2). The Facility and Waste Operations Division is responsible for pickup of waste and deposition to treatment facilities.

2.1 Hazard Identification and Analysis

All onsite work is performed based on two LIRs: "Documentation of Safe Work Practices" (LIR 300-00-02.2) and "Hazard Analysis and Control for Facility Work" (LIR 402-10-01.4). These LIRs ensure that the work is screened consistently to uniform criteria and that hazards are appropriately analyzed and

controlled. All contractors and subcontractors using chemicals on the site are responsible for managing the chemicals from the time the chemical enters the site or is issued to the user until it is dispositioned as reusable/recyclable, empty, or waste.

During the work-planning phase of a new job or project, all chemicals that will be used for the job or project are identified and assessed for potential health and physical hazards. Hazard analysis documentation or the equivalent operating manuals or procedures that govern processes and equipment are required for all work with known and suspected human carcinogens, chemicals of high acute or high chronic toxicity, known human reproductive toxins, and explosives. Any product chemical brought onsite by visitors or subcontractors must have an MSDS and must be reported to the host or the facility manager.

2.2 Acquisition

A centralized Chemical Stores subcontractor manages the procurement of all chemicals and laboratory supplies and onsite transportation of products to chemical users at LANL. Chemicals obtained through a purchase request are delivered to the Chemical Stores location, where ES&H Division personnel apply bar-codes and enter data into the ACIS. Gas cylinders and bulk gases are received and delivered by the Compressed Gas Processing Center in the Business Operations Division. A chemical purchase report is provided to ES&H division. This is the primary method to determine that bulk tanks have been refilled.

2.3 Inventory and Tracking

The ACIS is used to track chemicals onsite and to maintain inventories. This system also provides the necessary data and reports to prepare New Mexico Environment Department submittals and support for compliance, medical surveillance, exposure monitoring, facility authorization, and safe management. In addition, the ACIS tracks SARA Title III reporting of onsite hazardous materials and toxic release inventories. Each record contains a unique bar-code; the chemical content, including name, Chemical Abstract Service (CAS) number, amount, manufacturer, and catalog number; location of the chemical (technical area, building, room, and location comments); and its state (solid, liquid, gas), special temperature requirements, and ownership (group, owner's name, and owner's Z number). LANL subscribes to several MSDS services. Additionally manufacturers' MSDSs are scanned into an MSDS web site. Future enhancements of ACIS will connect an ACIS bar-code directly to an MSDS. Chemical owners can access a generic MSDS for a chemical name or CAS number, as well as all MSDSs for onsite manufacturers.

Viewing and updating ACIS data requires the proper ACIS authority. Chemical owners at LANL have full viewing and updating authority only over chemical containers in their ownership. To gain authority over all the containers in a group (ACGRP), the group leader must grant ACGRP. Access to an entire division's containers requires an e-mail from that division office, requesting that this level of authority be granted. The ES&H Division has provided a web interface that allows access to ACIS data for authorized users. Owners can use this web site in a number of ways. They can add a container, update the location of a container if it has been moved, mark a container as surplus for internal recycling, mark containers as disposed when the contents have been consumed, perform an annual inventory, accept a chemical transferred to their ownership, and transfer a chemical to another's ownership.

Chemicals in secondary containers are not tracked except when the building inventory has reached 80 percent of the threshold value for the chemicals listed in 40 CFR 68.130, "Chemical Accident Prevention." (This list can be found at http://frwebgate.access.gpo.gov/cgi-bin/get-cfr.cgi) An e-mail is sent to the management chain when a chemical has exceeded the 80 percent threshold in a building.

Emergency management and response personnel contact the line management chain detailing the consequences when the threshold is reached and the action required.

Chemicals on OSHA's Process Safety Management List are maintained in quantities below the threshold limit. (See http://www.osha-slc-gov/OshStd_data/1910_0119_APP_a.html)

Chemical owners are e-mailed when a peroxide forming or shock-sensitive chemical has exceeded its shelf life.

Owners are required to verify their chemical inventory annually in ACIS. They also must add bar-codes to containers and enter required information into ACIS for chemicals that were brought onsite by visitors, obtained as free samples from vendors, and purchased from other Just-In-Time vendors (e.g., acetone, paints, epoxies). The owner's line management chain is notified when the annual inventory has not been performed.

2.4 Transportation

Chemicals to be transported must be packaged by the compatibility group and must comply with packaging and transportation requirements (LIR 405-10-01.0, "Packaging and Transportation"). Containers that have explosives in them must comply with the requirements contained in the DOE Explosives Safety Manual and the packaging and transportation LIR. Federal DOT regulations in 49 CFR Parts 171-178 provide the guidance for transport, classification, and inspections of cylinders.

2.5 Storage

Storage includes bulk, tank, piping, cylinder, and container storage of solid, liquid, or gaseous chemicals. Used and unused chemical, laboratory-produced materials, those stored in partially filled containers and in containers other than original containers, and chemical "heels" left within tanks, piping, or containers are also maintained under storage. All incompatible compounds are segregated. Flammable/Combustible Liquids and Hazardous/Toxic Gas use and storage must comply with OSHA storage limits (OSHA standard 29 CFR 1910.106). LANL management recommends using the following NFPA guidelines for storage: NFPA No. 30, "Flammable and Combustible Liquids Code"; NFPA No. 45, "Fire Protection for Laboratories Using Chemicals"; NFPA No. 55, "Standard for the Storage, Use and Handling of Compressed and Liquefied Gases in Portable Cylinders"; and NFPA No. 704, "Standard System for the Identification of the Hazardous materials for Emergency Response."

Since peroxide-forming and shock-sensitive compounds have a limited shelf life, the line management chain determines a safe disposal plan for items having a short shelf life. Items kept beyond the recommended shelf life are visually inspected and tested to determine that they are safe to keep in inventory.

2.6 Control of Chemical Hazards

The Chemical Hygiene Plan, HAZ COM Plan, and Carcinogen Management Attachments to the Chemical Management LIR outline LANL's planning requirements for safe chemical management. These documents require all chemical containers to be labeled. The LANL Signs, Labels, and Tags Guidance Document provides instruction for hazard warning and control signs. Facility equipment and work requirements are designed to limit chemical exposures to a level below the OEL which is the lower value of either an OSHA PEL, TWA, or an ACGIH (1997) TLV, ceiling limit, or STEL.

2.7 Pollution Prevention and Waste Minimization

Chemical containers can be marked as surplus in ACIS. This allows users to check for chemical availability before placing a new order. All site contractors are required to follow the objective of minimizing the volume and toxicity of the LANL chemical product inventory.

2.8 Emergency Management

Procedures outlined in the Chemical Management LIR must be followed at the LANL site, and the ACIS must be used to track chemicals to ensure compliance with the Emergency Planning and Community Right-to-Know Act (EPCRA) requirements. Facility- or building-specific emergency response plans must be prepared. Site-specific emergency procedures requirements stated in LANL Emergency Management LIR 403-00-01 and the building requirements from the Emergency Management Plan (EMP 403-00-0), together with the facility Spill Control Plan constitute the facility or building emergency response plan. Each subcontractor at the site is responsible for proper response, notification, assessment, sampling, cleanup, decontamination, waste disposal investigation, and follow-up information related to spills.

2.9 Disposal

The General Waste Management Requirements LIR outlines the steps required to properly dispose of chemicals no longer needed onsite. The controls and requirements described govern activities associated with characterizing, segregating, packaging, and shipping waste chemicals for treatment and disposal. An MSDS is required to dispose unused chemical or a consumer product.

2.10 Training

All chemical workers are required to complete formal introductory HAZ COM (worker-right-to-know) training provided by ES&H Division. Training topics include how to detect hazards, how to interpret an MSDS, and labeling requirements. All LANL chemical workers must be briefed on the following activities and topics: operation and building chemical inventory, obtaining an MSDS, establishing ownership of chemicals, secondary-container-labeling requirements, building signs and postings, building emergency plans, the CHP or HAZ COM Plan, location of eyewashes and safety showers, spill response, and chemical storage requirements. Additional facility-specific training includes on-the-job training on the specific chemical hazards, procedures, PPE, and Hazard Control Plans. If workers use fume hoods equipped with an airflow-monitoring device, they must be trained on the indicators of ineffective operation.

Chemical Hygiene Officers must meet the chemical worker training requirements and have the education or experience to determine the hazards and consequences of exposure to the chemicals found on the chemical inventory.

Oak Ridge National Laboratory Chemical Management Program

1.0 Introduction and Scope

The UT-Battelle - Oak Ridge National Laboratory (ORNL) Worker Safety and Health Management System has been established to assist line management in ensuring a safe and healthy workplace is provided to all employees, visitors, vendors, and subcontractors of the Laboratory. ORNL has adopted the Integrated Safety Management System (ISMS) as the overarching philosophy and approach to systematically integrate safety into management tools and work processes. This document applies to all areas where hazardous chemicals as defined in 29 CFR 1910.1200, Hazard Communication, are stored, used, handled, received, distributed, and transported.

2.0 Chemical Life-cycle Program

An enhanced Chemical Safety Management Program (CSM) has been developed. It is a systems-based management approach designed to integrate and manage the life-cycle of chemicals including chemical acquisition, use, storage, and disposition. Requirements for the safe acquisition, use, storage, and disposition of chemicals are included in ORNL's Work Smart Standards and are implemented in the Standards Based Management System (SBMS) Chemical Safety Subject Area. The Operational Safety Services Division is the managing entity for CSM at ORNL with the Health and Safety Services Section as the sponsoring organization responsible for program implementation. This document will be updated as additional elements of the ORNL CSM Program are implemented.

2.1 Hazard Identification and Analysis

ORNL requires all work- or job-related activities to be evaluated for safety and health hazards through implementation of the Work Control Subject Area under the Work/Project Planning and Control management system which includes activities for routine, non-routine, and new work. The Work Control process for research and development is accomplished using the Research Hazard Analysis and Control System (RHACS). Identification and control of hazards is a line management responsibility and is shared between supervision and the employees performing the work with technical resources available through the Health and Safety, Fire Protection Engineering, Environmental Protection, Laboratory Waste Services, and Training disciplines. Hazard analysis also includes possible reactions from incompatible chemicals, possible interaction of chemicals with the building structure materials, containment vessels, and the general environment; other chemicals including those used or stored nearby; and effects over time of these potential reactions. Lessons Learned are also considered in the Work Control process.

2.2 Acquisition

Hazardous chemicals are routinely procured through the Systems, Applications, and Products (SAP) system through AVIDplus and by credit card through Logistical Services. Hazardous chemical purchases by personal credit card or petty cash are allowed only in emergency situations. A Hazardous Material Information System (HMIS)/procurement interface ensures that an up-to-date MSDS, Superfund Amendments and Reauthorization Act (SARA) information, and the location (Control Area) where the material will be used or stored are provided at the time of the purchase request.

Individuals purchasing hazardous materials by credit card or petty cash are required to enter the purchase information into the appropriate control area in HMIS and to ensure that an up-to-date MSDS is available on the MSDS database. The Hazardous Materials Inventory group evaluates all hazardous material requisitions, with the exception of those acquired through personal credit card and petty cash purchases.

The ORNL Chemical Management Center (CMC) has been established in order to facilitate the sharing of chemicals that have been identified as chemicals that still have value, but are no longer needed by their original custodian. HMIS provides users the capability of identifying chemicals for sharing through the Hazardous Materials Exchange List thus helping to minimize the quantities of hazardous chemicals brought on-site. Additionally, some ORNL divisions utilize Between Use Storage (BUS) areas in order to reduce waste and provide free chemicals to laboratory personnel.

2.3 Inventory and Tracking

Hazardous materials are tracked at ORNL via the centralized, electronic HMIS database. HMIS tracks chemicals from acquisition to the point that they have been declared waste. Each division has a HMIS representative who is responsible for the implementation of HMIS in their respective division. Divisions are responsible for determining an appropriate review schedule and ensuring that the hazardous chemical inventory is complete. A custodian is assigned to each hazardous material control area and is assigned the responsibility for maintaining the inventory and conducting a physical inventory annually at a minimum. Bar code labeling is currently utilized by some divisions as an inventory tool and modifications are currently being made to institute bar coding of chemicals throughout ORNL.

HMIS provides chemical thresholds, e-mail notification when new chemicals enter a work area, and facility safety reports, along with a variety of reports that allow custodians and other organizations such as Emergency Management and Fire Protection to determine the hazardous chemicals stored in a particular control area or facility. E-mail notification for time-sensitive chemical purchases, as well as e-mails for periodic inventory reminders, should be implemented by the end of FY01.

2.4 Transportation

Both onsite and offsite transportation of hazardous chemicals are conducted in accordance with the DOT and/or site requirements and guidance. Logistical Services may be contacted for guidance or assistance. Chemical inventories must be updated in the HMIS when ownership of chemicals is transferred.

2.5 Chemical Storage

ORNL has a large variety of chemicals on site, most of which are used in small quantities and rarely exceed reporting quantities. Guidelines for chemical storage are available in the Chemical Safety subject area procedure. These guidelines address chemical incompatibilities, storage of gas cylinders, flammable and combustible liquids, and peroxidizable and shock sensitive chemicals. The Chemical Safety subject area includes requirements and guidelines for chemical storage.

2.6 Control of Chemical Hazards

Processes for the safe use and storage, and disposal of chemicals are addressed in ORNL's Chemical Safety subject area. Specific requirements include hazardous chemical lists, chemical labeling, worker training, MSDS access, and where applicable, a written Chemical Hygiene Plan. Guidance is also provided on such topics as housekeeping practices, disposal of unneeded chemicals, fire prevention, emergency response, and spill response. Additional information is provided on chemical incompatibilities and peroxide-performing, and shock sensitive chemicals.

2.7 Pollution Prevention & Waste Minimization

ORNL's Pollution Prevention Program policy is to prevent all forms of pollution at the source whenever feasible. Where source reduction is not feasible, remaining materials must be minimized and recycled, reused, or reclaimed to the greatest extent possible. The Pollution Prevention Program is implemented by sharing available stocks of chemicals that have been identified as no longer being needed, promoting recycling and the use of recycled materials, using nonhazardous materials, and substituting less hazardous materials in ORNL activities whenever possible to minimize the potential risks to people and the environment.

ORNL established the CMC to facilitate sharing chemicals that have been identified as no longer being needed. Unneeded chemicals may be transferred to the CMC if they meet established acceptance criteria. By searching the Materials Exchange List or the CMC's homepage, chemical requesters may check for needed chemicals in both the CMC and other inventories before purchasing additional chemicals. Acquiring chemicals in this way helps minimize the quantities of hazardous chemicals brought on site. Access to the Materials Exchange List is available to all staff through the MSDS database.

BUS areas are established by some divisions in order to provide timely access to needed chemicals within the division. The primary mission of the BUS area is to conserve the resources of the research division by reducing the number of partially used chemicals that are declared as waste within a division. BUS areas may also reduce the cost of projects by providing free chemicals to laboratory personnel. Chemical inventories must be updated in HMIS when ownership of chemicals is transferred.

2.8 Emergency Management

The Oak Ridge Reservation Emergency Plan (ORREP) provides policies, standards, and emergency preparedness implementing procedures for effective emergency management of site hazards, consequence assessments, and protective actions in the event of a hazardous material release. The ORREP is based on the requirements of DOE Order O151.1A. Accordingly hazard assessments are conducted for all facilities at ORNL and are reviewed annually and revised as necessary. These assessments, along with the HMIS inventory reports, provide ORNL Emergency Preparedness with up-to-date information on hazards present within a facility.

2.9 Disposal

Hazardous waste at ORNL generated by research and operational divisions is packaged, characterized and certified by the generating division supported by Laboratory Waste Services. Final certification is performed by the Laboratory Waste Services Organization in accordance with the current revision of the Waste Certification Program Plan. Disposition of hazardous wastes has been the responsibility of Bechtel-Jacobs Company, LLC and their subcontractors. In the near future, UT-Battelle will resume the responsibility for hazardous waste disposition.

2.10 Training

Line management is ultimately responsible for the training and qualification of employees assigned to their organizations and for ensuring that employees are provided with job-related information that affects knowledge and skills necessary to perform their work.

Supervisors are responsible for the training, qualification, and performance of employees. They are required to review the qualifications of employees, subcontractors, visitors, and temporary employees in

order to verify that they possess the knowledge and skills required to perform assignments before being allowed to work independently.

All employees, onsite subcontractors, and guests are responsible and accountable for becoming knowledgeable of and maintaining awareness of chemical hazards associated with their work, for participating in the Work Control process, and for conducting their work safely. They are also encouraged to identify chemical issues for their workplace, to work with management to provide input for improvements and resolve concerns, and to exercise stop-work authority in cases of imminent danger.

Under ORNL's Chemical Safety subject area, employees receive information and training on the hazards of chemicals. They also learn methods for protecting themselves from these hazards, methods for detecting chemical hazardous chemicals, and ways to access information on the proper, use, storage and disposal of hazardous chemicals through the manufacturer’s MSDS and other resources. Additional chemical-specific training is conducted in accordance with applicable regulations.

Pantex Plant Chemical Management Program

1.0 Introduction and Scope

BWXT Pantex LLC, as the prime contractor, manages the Pantex site for the DOE. BWXT Pantex is committed to performing work safely using ISMS principles and has established programs for the safe and effective management of work with hazardous chemicals.

2.0 Chemical Life-cycle Program

2.1 Hazard Identification and Analysis

Pantex does not have any chemical processes that exceed the OSHA PSM Standard thresholds, except for explosives in Manufacturing Processes. Almost all of Pantex's chemical processes are also explosive manufacturing processes and are therefore managed per the PSM Standard. In addition, many non-explosive chemical processes are also managed per the PSM Standard as best business practice."

At Pantex, the preliminary hazards analysis takes the form of a questionnaire (PX-1245), which is used to collect information about facility inventories of highly hazardous chemicals, explosives, and nuclear material. This information serves as an objective basis for facility hazard classification. The information also allows ranking of facilities based on the quantity and form of nuclear material; the consequences associated with an explosive event, as well as the type of explosives operation; and the consequences of a release of highly hazardous materials.

Pantex uses its Facility Hazard Classification as the basis for determining if a facility is "nuclear" (which requires the development of Authorization Basis Documents) or if a facility requires control under the plant's PSM program because it is classified as an Explosive Manufacturing Operation or has threshold inventories of Highly Hazardous Chemicals. The Preliminary Hazard Analysis serves as the safety basis for facilities that are not classified as nuclear or covered by PSM.

The techniques used to complete PHAs include "What-if" analyses, Explosive Safety Checklist Analyses, General Industry Checklist analyses and FMEA analyses. The information from Preliminary Hazards Analyses, previous Final Safety Analysis Report analyses, Fire Hazards Analyses, and other analyses are used to support PHAs.

A multifunctional team that includes a PHA Leader, Facility Manager, Operations Manager, Process Engineer, Process Operator/Engineering Technician, and Explosives Safety Expert completes the PHA (per the requirements of 29 CFR 1910.119). The PHA leader is trained and certified in the analysis techniques that are used. The Facility Manager provides expertise in the management, maintenance, and design of the facility. The Operations Manager and Operator provide expertise in the operation and ergonomics associated with the processes In addition to the designated team members, several subject matter experts, such as Industrial Hygiene personnel, Waste Operations personnel, Fire Protection personnel and Electrical Classification personnel usually are consulted during the performance of a PHA.

PHAs are performed using the software program Leader 4.0, from EQE International, Inc., in Knoxville, Tennessee. These analyses typically yield action items that have the potential to significantly affect safety and recommendations that address minor safety concerns or increased efficiencies. Per the plant procedure, action items must be acted upon; and recommendations must, at minimum, be evaluated by the Facility Manager.

The PHA is the definitive analysis for non-nuclear chemical facilities at the Pantex Plant and is used to supercede all of the previous analyses. PHAs are also used to write the Safety Basis Document for non-nuclear chemical facilities. This document identifies all of the systems important to safety and the administrative controls required to mitigate or prevent the consequences of interest as defined in the plant procedure.

Pantex has also prepared Specific Hazards Analyses in support of the Safety Basis for Nuclear Facilities. An example of this is the analysis of a chlorine release from the water treatment plant. This analysis focused on the effect of a chlorine spill on the operations within Nuclear Facilities.

2.2 Acquisition

Requestors of new chemicals are required to submit a Pantex Form PX-761, Chemical Request Form. The requestor provides the name of the chemical, its proposed use, estimated frequency and quantity of use, where it is planned to be stored and used, and any engineering controls and/or PPE that are planned to be used in conjunction with the new chemical. After the requestor's portion of the form is completed, the requestor forwards it to the Chemical Control Committee for review. Following final approval, the PX-761 is entered into a database that is accessible by all of the procurement personnel on the site. They routinely check this database to ensure that the item has been approved prior to placing the order.

An item that does not require any excessive reviewer comment or special handling can be processed completely through the system in 2 to 3 work days. An emergency request can be completely processed in a matter of hours if all of the necessary reviewers (or their alternates) are available. It is reasonably rare for any request to take more than 5 work days to be processed. Although this sounds like a long involved process, the simultaneous review by multiple committee members and the electronic routing of the form on the Plant unclassified network actually moves the process along rapidly.

2.3 Inventory and Tracking

The Hazard Communication (HazCom) Group maintains approximately 14,000 MSDSs in the Master MSDS Library. As each MSDS is received, the HazCom Group processes it, examining it for completeness and correctness. If the HazCom Group finds any errors in the data, they contact the supplier of the MSDS to alert them to the error. Sources used for comparison of data include National Consensus Standards, OHSA Standards and Publications and a third-party MSDS Service (MDL-OHS MSDS on CD-ROM).

Each MSDS has a unique number assigned to it, known as a P-Number. The P-Number is a six-digit identifier (five digits and one decimal place) that can be used to track a specific MSDS by the type of chemical that it represents and the manufacturer or supplier of that product. When there are numerous manufacturers or suppliers of the same product, the decimal place differentiates them. An example would be isopropyl alcohol. The first five digits for all isopropyl alcohols are 00518. However, since it is a fairly common chemical, it is purchased from a number of different sources. The P-Number for isopropyl alcohol from Allied Chemical Company is 00518.1; the P-Number for isopropyl alcohol from Ashland Chemical is 00518.3. When there are more than nine manufacturers or suppliers, two decimal digits are used to continue this logic.

After a P-Number has been assigned, the MSDS is reviewed for labeling using a labeling system that was developed locally. This label is similar to the NFPA label system, except rectangles, instead of diamonds, are used for the four label identifiers. The item is labeled on a scale of zero to four (0-4) in each of three categories (Health, Flammability, and Reactivity). A fourth block is used to indicate the normally expected form of the material. In addition, there is a Special Information Block where such things as carcinogen status, reproductive hazards, skin irritation potential, acid or water reactivity, and so on are listed. The label also has a large alpha character on it to identify the storage classification.

When a material has been authorized for purchase and procured through normal channels, as described above, the material is received through the Receiving Section of General Stores. Personnel in the Receiving Section access the labeling database and the system automatically prints as many labels as they request for the incoming material. This label includes a 12-digit bar-code that uniquely identifies any given container of hazardous material. The 12 digits are derived as follows. The first 6 digits of the bar-code are the P-Number for that product. If the P-Number has two decimal places because there are more than 9 suppliers, the numbers higher than 9 are indicated with alpha characters. The 7th digit of the bar-code indicates the year in which the product was received, and the remaining 5 digits are sequentially numbered for the number of containers received for that year. For example, if the Receiving Section received a gallon container of Isopropyl Alcohol from J. T. Baker Chemical Company (P-Number 00518.13), and this was the 1,215th container received this year, the bar-code numbers would be 00518DB01215 (00518 = isopropyl alcohol; D = the 13th manufacturer code [A=10, B=11, C=12. D=13], B = 2001, and 01215 = the 1,215th container of this material received this year).

When the labels are produced, the bar-code number is automatically generated and assigned to that container. The Receiving Section employee who requests the labels will input the quantity and number of containers received. The system stores this information in a tracking database. At the same time, a duplicate entry is automatically generated into a historical database that maintains this information as permanent.

When a container is moved from one onsite location to another, the workplace supervisor is responsible for notifying the HazCom Group of the planned move. The HazCom Group ensures that the necessary reviews have been completed to approve the chemical to be in the new location and will then update the computer database to show the new location.

2.4 Transportation - Not addressed

2.5 Storage

The Pantex storage compatibility system was locally developed. Organic and non- organic acids and bases and oxidizers are each assigned a separate code; all other chemicals are placed in the "General Chemical" category. Each category is assigned a different alpha character designator. The rule is that "A's can be stored with A's, B's can be stored with B's," and so on. Flammable materials (flammable rating of 2,3, or 4) must be stored in a flammable storage cabinet, and all carcinogens must be stored away from other chemicals. All of this information is entered into the onsite labeling database computer system.

2.6 Control of Chemical Hazards

The Pantex Chemical Control Program is designed to allow for a thorough review of any new chemical that is proposed to be brought onsite before an order is placed. For the purposes of this program a "new chemical" is any chemical that is proposed for purchase in a specific work center where it has not been

ordered before. If a given chemical is in use in other places onsite, but has not previously been used in this specific shop, it is considered a new chemical. The Chemical Control Committee is not a standing committee in the sense that it meets on a regular basis to review the PX-761 forms. Instead it is a designated group of reviewers who have responsibility to conduct their specific portion of the review on an "as needed" basis.

The form is first routed through the HazCom Group to obtain a current Material Safety Data Sheet (MSDS) for the chemical being requested. That MSDS is scanned into the plant's online MSDS system and immediately becomes available to all plant employees. The PX-761 is then forwarded electronically, using a program platform called Optix, to an Industrial Hygienist, who is assigned responsibility for the IH program in the area where the chemical is proposed for storage and/or use. That Industrial Hygienist conducts a review of the existing engineering controls and makes any necessary PPE call-outs for employees who will be using this material.

Once it has been reviewed and recommended for approval by the IH Technician, the PX-761 is routed to the Industrial Hygiene Section Manager for review and approval. It is then electronically routed to at least four other Chemical Control Committee members. Those four areas are Fire Protection Engineering, Fire Department, Waste Management, and Environmental Protection.

Additional members of the Committee are included in the review process on an "as needed" basis, depending on the characteristics or uses of the chemical being ordered. For instance, if the material is highly energetic or may be used in the fabrication of explosives or explosive devices, the Explosives Safety and/or Nuclear Explosives Safety Department will review the form. The site Chemical Hygiene Officer reviews the form when a chemical is being requested for any of the several laboratories onsite. The Radiation Safety Department reviews the form for any chemical that has a radioactive potential is reviewed by the Radiation Safety Department, and additional reviewers are called upon for chemicals requiring their area of expertise.

Each reviewer in this process has the opportunity to request additional information and make any applicable comments or recommendations on this request. Ultimately each reviewer will recommend it for approval or disapproval, based on the hazards that the chemical presents in their area of expertise. The final reviewer is the Plant Chemical Control Coordinator. The Chemical Control Coordinator reviews all comments and recommendations and gives the final approval or rejection of the request. The Chemical Control Coordinator may approve the request, even when there is a recommendation for disapproval, if there is sufficient reason to do so. Usually this is only done for "one-time- only" or emergency action type requests. In most cases, a recommendation to disapprove from any Chemical Control Committee member will lead to disapproval by the Chemical Control Coordinator.

2.7 Pollution Prevention and Waste Minimization

All Pantex employees are an active part of a comprehensive Pollution Prevention Program. Pollution Prevention (P2) and the ISMS work hand-in-hand to assure waste generation is minimized to the most practicable amount possible.

One activity that highlights P2 in a model chemical management system is the control of chemicals purchased by a facility. At Pantex Plant this process is implemented through the use of the PX-761 process. The requestor completes the PX-761, Pantex Chemical Request Form, before the chemical is purchased. The form is reviewed by personnel from the Occupational Safety & Health Department, Fire Department, Fire Protection Engineering Department, Waste Operations Department and Explosives Safety Department. This review ensures that the chemical is safe for use with the proper controls in place

before it is introduced into the work area. The Waste Operations Department also reviews the PX-761 for the following:

- If the material is hazardous, is a nonhazardous substitute available?
- Will the material affect reporting requirements under EPCRA?
- How will the material be disposed of when spent?
- Will use of the material affect permits or permitting requirements?

Recycling activities are a preferable alternative to waste disposal at Pantex. When chemicals are purchased, opportunities are sought to reuse or recycle the material. Many times the material requested can be substituted with a chemical already approved for use at the Plant.

2.8 Emergency Management

The Pantex Emergency Hazards Assessment (MNL-190881) includes quantitative hazards analyses of onsite chemicals that exceed either the TQ in 29 CFR 1910.119, or the TPQ in 40 CFR 355 Appendix A. This document includes hazard identification and characterization, development of accident scenarios, and consequence analysis using airborne dispersion modeling.

2.9 Disposal

When a container is emptied (and there are specific rules for how to determine when it may be considered empty) the end user is responsible for notifying the HazCom Group that the container has been emptied and disposed of. Notification is made using form PX-1447, Drum Inventory of Aerosol Containers or Empty Containers. The user may either write the 12-digit bar-code on the form or (if using a newer label) peel off the section of the label in the area of the bar-code and affix it to the form. When the HazCom Group receives the forms, the written bar-codes are keyed in and the peeled labels are scanned with a hand scanner. That information is used to update the tracking database. When the container has been used up and disposed of, the entry is deleted from tracking. At the same time the historical database is updated to show when the item was removed. With these two databases, we are able to show what is currently believed to be in the active inventory and what has been in the inventory over time.

2.10 Training - Not addressed

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Sandia National Laboratories Chemical Management Program

1.0 Introduction and Scope

Sandia National Laboratories (SNL) is committed to performing work safely and ensuring the protection of the workforce, the public, and the environment. Sandia is also committed to performing work effectively and efficiently, ensuring that its customers receive the best possible value for each dollar spent. Through implementation of ISMS, Sandia expects to achieve improved safety performance and a consistent set of safety policies, objectives, principles, and management functions.

2.0 Chemical Life-cycle Program

2.1 Hazard Identification and Analysis

Before any new work is begun, managers are responsible for ensuring that hazards are identified, analyzed, and controlled to minimize adverse consequences and/or the likelihood of adverse consequences. They also ensure that hazard identifications, analyses, and emergency plans are current and that all administrative and engineering controls are in place and operational. Managers are tasked with informing workers about the hazards and hazard controls applicable to the activity in which they are involved and for ensuring that the identified risks are acceptable. It is also a management responsibility to ascertain that the Authorization Basis and Readiness Review requirements have been completed and that the ISMS software has been used to identify and document the following for all operations: hazards, project/activity classification (facility, laboratory, office), hazards classification, training requirements, and safety documentation. They also ascertain that the ISMS software has been used to analyze hazards for low-, moderate-, and high-hazard non-nuclear operations, accelerators, and nuclear facilities.
SNL personnel who direct day-to-day work activities are responsible for knowing the hazards associated with the work and the controls needed to perform the work safely. They are also expected to integrate ES&H requirements from sitewide institutional sources, facility-specific sources, and project-specific sources and ensure that all required controls are properly in place before work begins. SNL personnel also have the responsibility for reporting to management any work situations or practices they observe that do not comply with safety responsibilities.

2.2 Acquisition

Chemical acquisition procedures vary a bit among SNL sites (i.e., Livermore, Nevada, and Kauai). The preferred method of purchasing chemicals is through SNL'S Just-In-Time (JIT) vendors. Most chemical users phone the vendors directly with chemical orders. The JIT vendors enter the order information into SNL's purchasing software (Oracle) and provide inventory tracking bar-codes and information to Sandia, then deliver the chemicals directly to the labs.

If a chemical can not be purchased through the JIT vendors, a laboratory owner may submit a purchase requisition to purchase chemicals. If this method is used, the laboratory owner is responsible for inventory tracking and bar-coding. Chemicals purchased using a purchase requisition are delivered to SNL's centralized receiving area.

2.3 Inventory and Tracking

The Chemical Information System (CIS) is used for chemical container tracking (inventory) and MSDS access. The system data is updated daily. Each container is bar-coded either by the JIT vendor, the laboratory owner, or the chemical inventory team. Every employee at SNL can view the data and perform searches. The bar-code number on each container allows access to information about the chemical name, location , quantity, NFPA codes, SARA codes, CAS number, specific gravity or density, and corresponding MSDS, synonyms; mixture ingredients and percentage; vendor information; dates in and out; and chemical owner. Information is obtained from the JIT and other vendors, lab owners, and the Chemical Inventory Team. Vendors supplying bulk quantities of chemicals (diesel fuel, liquid nitrogen, etc.) notify the CIS Team when they fill tanks.

The CIS maintains a running total of quantities of all chemicals so yearly totals can be calculated. A wall-to-wall chemical reconciliation is performed annually to maintain the accuracy of the chemical inventory. In addition, throughout the year, laboratory owners can add chemicals to their inventory and remove or transfer them from their inventory electronically. Sandia's Waste Management organization provides weekly disposal information from bar-coded containers that are disposed through that organization's process.

CIS information is used to generate a number of reports, including those for Emergency Planning, EPCRA, city, county, and State Air Quality information, DOE information requests, OSHA Process Safety, carcinogens, reproductive toxins, pollution prevention, and Information for the NEPA process.

2.4 Transportation

Requirements for transportation packaging and transporter training vary based on the degree of the hazard and the travel route and distance. Sandia's ES&H Manual provides a detailed description of these requirements for the members of the SNL workforce. When on non-Sandia controlled premises, the requirements and practices of the host facility apply.

In terms of transportation, chemicals are divided into two hazard categories: High and Low. The High category includes explosives (categories 1.1, 1.2, 1.3), dangerous when wet (4.3), organic peroxides (5.2), poison inhalation hazards (6.1 and 2.3), and infectious substances. The Low category includes low flammable solids, flammable gases, corrosives, explosives (1.4 and 1.5), and biological hazards not in the high category.

When transporting High category chemicals between Technical Areas, members of the workforce must provide hazmat-trained packaging and transportation specialists to conduct the transport, DOT labels, documentation (e.g., transfer papers), placarding, strong/tight packaging, tie downs, and government vehicles for the transport. Infectious substances must be triple-packed and labeled. Placarding is not required when transporting high hazard material within the technical areas.

When transporting Low category chemicals between Technical Areas, members of the workforce must provide hazmat-trained packaging and transportation specialists to conduct the transport, strong/tight packaging and tie downs, some form of communication such as labeling or Technical Work Documents, and government vehicles for the transport. Hazmat training is recommended, but not required, when transporting low hazard material within the technical areas.

All offsite shipments of hazardous material are performed exclusively by the shipping organization.

2.5 Storage

Chemicals must be stored and segregated properly. Guidance on storage is obtained from the MSDSs and input from ES&H subject matter experts. Proper maintenance of chemical storage is validated during periodic walk-throughs of storage areas.

Aerosol cans containing flammable substances must be stored in FM-approved or UL-listed flammable liquid storage cabinets. Flammable liquids must be stored in flammable liquid storage cabinets or explosion-proof refrigerators rather than fume hoods.

All other chemicals must be segregated according to chemical class based on the hazards documented in the MSDS. Chemical storage classes most often are acid, base, oxidizer, flammables, and others. Numerous buildings at SNL have centralized storage areas where chemicals are stored and segregated according to chemical class. Chemicals are moved to the labs or production area on an as-needed basis. This reduces the quantity of chemicals stored in individual labs and facilitates chemical purchasing efficiencies.

SNL has numerous chemical storage tanks. The CIS maintains an inventory of these tanks. All Underground Storage Tanks (UST) must be installed according to code by an installer who has been certified or licensed by the UST Bureau. UST owners must maintain and test leak detection systems according to the manufacturer's instructions. They also must arrange for and fund UST system inspections and tests according to the following schedule: tank tightness (5 years), suction piping tightness (5 years), pressurized piping system tightness (1 year), cathodic protection system (within 6 months of installation and then every 3 years), impressed current-type cathodic protection systems inspection (60 days)

2.6 Control of Chemical Hazards

The control of chemical hazards at SNL is documented in the Primary Hazard Screen and Hazard Analysis process for every project or facility. Work-specific technical work documents provide more detailed chemical hazard controls. Hazard control is based on the hierarchy of controls: engineering controls first, administrative controls next, and personal protective controls last. ES&H subject matter experts provide input on appropriate controls to chemical users and their management.

The majority of chemical use at SNL is regulated by OHSA’s Laboratory Standard. Managers of SNL personnel who engage in the laboratory use of hazardous chemicals are responsible for ensuring that physical hazards and health hazards associated with hazardous chemicals used in laboratory operations have been identified, evaluated, and controlled. They are also responsible for ensuring that SNL worker exposures to hazardous chemicals is controlled and does not exceed the OSHA Permissible Exposure Limits (PELs) or American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). Managers must determine and implement control measures based on hazard evaluations, which may include monitoring and/or consultation with their Division ES&H Team. Potential exposure through eye and skin contact is prohibited where specified by any OSHA Expanded Health Standard. Managers initiate exposure monitoring for beryllium and OSHA-regulated substances (OSHA Expanded Health Standard) if there is reason to believe exposure levels for that substance routinely exceeds the action level (or the OSHA PEL or ACGIH TLV in the absence of an action level).

SNL personnel have the opportunity to receive medical consultation if they develop signs and symptoms associated with a possible exposure to a hazardous chemical when an event (spill, leak, explosion, or other occurrence) in the work area results in the likelihood of a hazardous exposure and when exposure monitoring reveals exposure levels that routinely exceed the action level (or the OSHA PEL or ACGIH

TLV in the absence of an action level) for OSHA-regulated substances requiring medical surveillance. SNL managers whose personnel engage in the laboratory use of hazardous chemicals are responsible for ensuring that personnel receive medical consultation in any of these circumstances.

Managers are also responsible for reviewing and approving laboratory operations, procedures, or activities when a new chemical or change in process is introduced that creates a potential health hazard to SNL personnel and which has not been evaluated by cognizant SNL personnel and/or their Division ES&H Team. They also ensure that engineering controls (e.g., fume hoods) and other protective equipment, such as eyewashes, safety showers, and PPE, are functioning properly and used appropriately.

Managers of laboratory personnel also ensure that additional provisions for personnel protection are made for those who work with particularly hazardous substances and that work with particularly hazardous substances covered under the OSHA Laboratory Standard is performed in a designated area. They must also ensure that SNL personnel understand and comply with SNL's Chemical Hygiene Plan and 29 CFR 1910.1450 (and its appendices), as well as the additional requirements defined in the "Hazard Communication Standard," and the TSCA for chemicals that are developed in the laboratory or imported into the laboratory.

SNL personnel are responsible for informing management before using a hazardous chemical in an application for which a potential exposure exists that has not previously been evaluated, as well as for conducting laboratory operations according to SNL's CHP.

SNL’s policy regarding chemical labels is that they are not be removed or defaced. In addition, policy requires secondary containers to be clearly labeled with the chemical name and primary hazard. The CIS maintains the MSDSs, which are accessible to all through the internal computer network or by phone.

Managers of HazCom areas are responsible for ensuring that exposure of workers to hazardous substances is controlled such that they do not exceed OSHA's PELs or ACGIH TLVs, whichever limit is most restrictive. They also are responsible for ensuring that SNL personnel meet applicable requirements in OSHA Expanded Health Standards listed in 29 CFR 1910.1000, Subpart Z, “Toxic and Hazardous Substances.”

HazCom area managers ensure that a list of the hazardous chemicals (using identities referenced on the appropriate MSDSs) known to be present in the work area is accessible to SNL personnel and that SNL personnel are informed of the hazards associated with nonroutine tasks and with chemicals contained in unlabeled pipes. (This may be accomplished through site-specific training, health and safety meetings, and technical work documents.)

Space owners must ensure that non-SNL personnel (e.g., contractors) who may be exposed to SNL hazardous chemicals in the work area under normal conditions of use or in a foreseeable emergency have access to MSDSs for each SNL-owned hazardous chemical to which they may be exposed. They also are responsible for ensuring that SNL personnel are informed of precautionary measures (e.g., PPE, alarms) to protect themselves during normal operating conditions and foreseeable emergencies and that they are informed of any labeling systems used in the work area that are not self-explanatory.

2.7 Pollution Prevention and Waste Minimization

Sandia's Pollution Prevention staff is available to project leaders to help them investigate ways to reduce chemical usage, substitute with less toxic chemicals, and reduce the laboratory’s consumption of ozone depletors, solvents, aerosols, and waste. In addition, laboratory owners pay a fee for all chemicals going to Hazardous Waste. This charge-back policy promotes responsible chemical usage.

Using the CIS inventory web page queries, personnel can obtain information on chemicals they need that are already onsite. This facilitates the sharing of chemicals, thereby avoiding the costly purchase and disposal of excess chemicals. This Waste Minimization concept is called "Purchase Avoidance."

2.8 Emergency Management

Sandia's Emergency Management organization uses CIS data to plan for potential emergencies in higher hazard facilities. During a drill or accident, CIS data and MSDSs are used for toxicological, evacuation, air modeling, and personal protection information. Emergency Operations Center personnel, medical personnel, and Incident Commanders are trained to efficiently find chemical information through CIS.

2.9 Disposal

Sandia complies with all Federal and state requirements for waste disposal. Waste generators can accumulate and manage hazardous waste in a satellite accumulation point or less-than-90-day accumulation areas. Waste generators identify their waste to determine the applicable management and disposal requirements. All waste generators attend training that provides them with the necessary information to ensure compliance with all Federal, state, and SNL satellite accumulation point requirements. Topics include sources of chemical waste information, chemical waste definition, container selection, labeling requirements, storage requirements, accumulation time and volume limits, definition of empty containers, waste disposal procedures, and specific waste stream disposal guidance.

2.10 Training

Sandia has a comprehensive training program for those personnel who work with all hazards at SNL. Initial training is determined by completing the Primary Hazard Screen (PHS). Once personnel answer the questions in the PHS, the PHS software identifies the required training. Managers can also specify additional training. All personnel who work with chemicals are either required to take the Laboratory Standard or HazCom courses. In addition, anyone who generates waste is required to take Waste Generator training. Personnel responding to accidents or emergencies are required to complete HAZWOPER training.

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Savannah River Site Chemical Management Program

1.0 Introduction

Westinghouse Savannah River Company (WSRC), as the prime contractor, manages the Savannah River Site (SRS) for the DOE. Projects related to past, present, and future missions have used and continue to use chemicals in a variety of processes. The SRS CMP was established to ensure that the management of chemicals complies with applicable Federal, State and local regulations, DOE directives, and the contractual provisions with DOE, as stated in the Standards/Requirements Identification Document (S/RID).

The SRS CMP also aims to ensure that the core elements of the ISMS are adopted at each process or activity level. Safety is of utmost importance to SRS employees, as evidenced by the "VPP Star" status granted by DOE-HQ in 2000 for the quality of the DOE-Voluntary Protection Program (VPP) at SRS. Also, SRS received certification under the ISO 14001, "Environmental Management Systems – Specification with Guidance for Use" program in 1997.

The Chemical Commodity Management Center (CCMC) at SRS is the organization designated to establish SRS chemical management policy and help implement the SRS CMP on site. The SRS CMP does not rely on the CCMC efforts alone because chemical safety is recognized at SRS as the responsibility of *ALL* employees. The CMP takes input from the SRS Chemical Management Committee at the Division level, and from the chemical coordinators at the field level, and provides a common focus to those working with chemicals from various line organizations. CMP implementation is achieved through compliance with site-level and facility-specific procedures that govern activities associated with chemicals, oversight by CCMC and other WSRC organizations, and the use of communication tools, such as, the Chemical Life Cycle Management homepage and its links on SRS Intranet (see Section 2.0). The CCMC manager coordinates the SRS CMP and serves as the single point of contact for all chemical issues.

WSRC has established a site-level Chemical Management Committee (CMC) to address chemical safety management. This committee consists of members having the authority to address issues for their Division's Vice-President and the responsibility to implement all committee decisions within their divisions. The DOE Field office at SRS, as well as, WSRC Divisional Support organizations such as Industrial Hygiene, Transportation, Fire Protection, and Emergency Services, are also represented at the CMC. The CCMC manager chairs the committee and holds monthly meetings.

Each site organization has a chemical coordinator, who is a trained, facility-level person, responsible for day-to-day chemical safety and OSHA HazCom compliance issues. The chemical coordinators are matrixed to the CCMC for guidance and training. They also attend monthly meetings organized by the CCMC.

2.0 Chemical Life-cycle Program

The SRS CMP requires chemical hazards to be examined at every stage in the life cycle of the chemical. The first option is to eliminate the use of a hazardous chemical if possible. Where elimination is not practicable, the minimum amount required for the application is procured. Other areas to be examined include, but are not limited to, the potential impact on safety basis in selection of the warehousing facility, onsite transportation, designation of storage locations within operating facilities, handling and use, and

disposal of the chemical. WSRC uses both in-house technical expertise and subcontracted technical support to perform these functions.

The diverse technical staff of CCMC includes procurement specialists and degreed professionals in Industrial Hygiene, Environmental Engineering, Chemistry, and Chemical Engineering. The CCMC administers the site Chemical Procurement Program, the SRS Hazard Communication Program, and the Excess Chemical Program. The CCMC develops any procedures required for sitewide implementation of the CMP. It also has oversight responsibility on chemicals and chemical safety in activities ranging from acquisition, to storage and use in the operating divisions, and redistribution through the Excess Chemical Program. Federal, state, and local regulations, DOE directives, and Industrial Best Practices are used to formulate site-level and facility-specific procedures. Individual line organizations and support personnel are responsible for the various activities involving chemicals in their facilities, including disposal. The CCMC is responsible for the Chemical Lifecycle Management homepage on the SRS Intranet. The homepage lists the CCMC staff, the CMC representatives, and the chemical coordinators. Employees with a chemical safety concern can quickly identify and reach any of the listed personnel. Other elements on the homepage include chemical ordering information, chemical compatibility, transportation, disposal, and excess chemical information; a link to the SRS MSDS database; links to useful information; policies and procedures; SRS chemical hazard ratings; and target organ effect information.

2.1 Hazard Identification and Analysis

The "WSRC Facility Safety Document Manual" governs the requirements for safety basis documentation for nuclear and non-nuclear facilities, using a graded approach to classify the facility hazard categories. Typical safety basis documentation includes Safety Analysis Reports for nuclear facilities and Auditable Safety Analyses for non-nuclear, (i.e., radiological and chemical) facilities. To evaluate chemical hazards, the facility hazard classification is based on a comparison of the chemical inventory with regulated quantities. These include the Reportable Quantities (RQs) listed under CERCLA (40 CFR 302.4), Threshold Planning Quantities (TPQs) per SARA (40 CFR 355)**,** and Threshold Quantities (TQs) per OSHA-PSM, 29 CFR 1910.119 (PSM Plan), and EPA-RMP, 40 CFR 68 (Risk Management Plan). A high-hazard chemical facility that has chemical inventories equal to or exceeding any of the TQs, requires a "Process Hazards Analysis" (as described in the OSHA-PSM) to satisfy both PSM and RMP rules. For low-hazard chemical facilities with chemical inventories at or above the CERCLA RQs, but below the TQs and TPQs, an Auditable Safety Analysis with administrative limits will suffice as the safety basis documentation.

For new facilities and upgrades of existing facilities, process hazards associated with chemicals are identified through the Process Hazards Review (PHR) program, beginning with the Preliminary PHR during the conceptual design phase, followed by the Design PHR during the design phase, and finally, the Preoperational PHR during the installation phase.

In the case of existing facilities, any change in the process or process chemicals results in a Screening PHR that qualitatively evaluates the change for potential impact on worker safety, property loss, or offsite releases to the public. If the Screening PHR results in a finding that the change may have an adverse impact (by exceeding specific accident criteria) on safety or worker protection, a full PHR is performed to identify existing protection and any additional safety measures to be implemented. Existing facilities perform periodic PHRs to ensure that no existing hazards have been overlooked and no new hazards have been introduced into the process since the last PHR. Non-process hazards (i.e., standard industrial hazards) are covered in site procedures, for example, in the WSRC Employee Safety Manual and are not included in the PHR. Job hazard analyses (JHAs) are developed, as necessary, to identify and mitigate hazards associated with a clearly defined scope of work activity.

Safety basis documents are reviewed and updated, if necessary, at frequencies specified in the Facility Safety Document Manual. Additionally, a formal Management of Change Program for Safety Basis Documentation is in place.

2.2 Acquisition

The CCMC is the only site organization authorized to approve the purchase of chemicals and chemical products. Chemical request forms sent to the CCMC undergo a review to ensure that the chemical or chemical product is not a currently stocked item; the chemical is not available through the site Excess Chemical Program (see Section 2.7); the Site MSDS database has a current material safety data sheet (MSDS); the chemical does not pose an unreasonable risk to the workers or the environment; and the requestor provides written justification for the use of any carcinogenic or ozone-depleting chemical product to be purchased.
Once the review is completed, the CCMC places the purchase orders using existing JIT contracts and strategic source contracts, as much as possible. This expedient process has reduced the amount of chemical products being warehoused and the associated operational cost of warehousing. For products with a limited shelf life, strategic sourcing and JIT delivery provide another benefit by eliminating the potential cost of disposal of stored items that may become non-viable, if not monitored properly. The Operating and Support organizations are now less inclined to store chemical products beyond their normal consumption patterns as they have become accustomed to the improved service provided by the CCMC. With reduced chemical inventories in these organizations, the risk of employee exposure to the chemicals decreases, as does the risk of a chemical release. The total amount of chemicals stored at SRS has been reduced by 85 percent over the past 6 years (see Section 2.7).

2.3 Inventory and Tracking

The WSRC sitewide chemical inventory is maintained in a controlled chemical database that allows integration of information residing in three modules: the MSDS module, the Inventory module, and the Chemical Catalog module. The MSDS module contains records of technical and compositional data extracted from the MSDSs of chemical products used at SRS. The chemical ingredient data associated with each MSDS is linked to a library of chemical and regulatory information, maintained and updated by the CCMC, within the database. The Chemical Catalog module contains material ID records of chemical products identified to the container level, as well as chemical procurement information. The material ID is linked directly to the appropriate MSDS. The Inventory module includes information on the storage facility identity, responsible organization, material ID, material description, storage location by row and column, individual container or unit size, number of containers, and similar information. Procedures require the chemical coordinators to update their chemical inventories at least on a monthly basis.

For tracking purposes, chemicals purchased and received through the Central Receiving Facility are bar-coded prior to onsite distribution. Products deemed “articles” in accordance with the OSHA HazCom standard, as well as some consumer use items are not bar-coded. Bulk chemicals delivered to the process areas are not bar-coded, but their inventories are monitored.

Facility inventory information is used to monitor the chemicals regulated under the OSHA PSM, the EPA RMP, SARA, and CERCLA regulations in order to comply with Administrative Limits specified in the facility safety basis documentation.

Inventory and tracking of chemicals are primarily driven by Federal regulations, DOE requirements, and good business practices. Various site organizations utilize the chemical database as an information source for compilation of regulatory and DOE-required reports, for example, the EPCRA Tier II inventory, the Toxic Chemical Release inventory, the Ozone Depleting Substances inventory, the Air Emissions

inventory, the Precious Metals inventory, and others. Guidance on regulatory reports is provided to site organizations by the Environmental Protection Department, which reviews the compiled data and submits a formal report to the appropriate regulatory agencies.

2.4 Transportation

Chemical shipments arrive at the Central Receiving Facility, where shipping manifests are reviewed and processed. SRS transportation personnel deliver all chemicals, other than bulk process chemicals, to the end user directly or through a nearby Material Access Center (MAC). Bulk process chemicals are delivered to the process area facilities by the vendor after the shipping manifests have been processed at the Central Receiving Facility.

Following a graded approach, general guidelines are used to manage the interim handling of chemicals during the transition period from the initial point of receipt to the final delivery point because these chemicals are not being used, but just handled and transported. Chemical compatibility is still a consideration even when handling, storing, and transporting chemicals on a short-term basis. The WSRC Transportation Safety Manual addresses the requirements for onsite and offsite transportation of chemicals. DOT regulations apply whenever a chemical travels on or across a road with public access, or is shipped offsite.

Onsite movement of newly procured chemicals from Central Receiving Facility to the area MAC and to the end user facility is performed by SRS transportation personnel. Movement of excess chemicals between site facilities and the Excess Chemical Warehouse is coordinated through the Site Hazardous Material Transportation Representatives to assure compliance with DOT-Hazardous Material Transportation Regulation (49 CFR 172-174) requirements.

2.5 Storage

When chemicals reached the end-user facility, a determination is made as to their immediate use or storage requirements, including the designation of physical storage locations**.** Consistent with a graded approach, the storage requirements for chemicals awaiting shipment to another facility or location are less stringent than those for chemicals stored in a given location for a longer period. There is a greater potential for exposure to chemicals during use than during storage. Therefore, the handling requirements would be more stringent during use than in storage. Regardless, safe segregation based on chemical compatibility is an overriding consideration in all situations.

Site-level and facility-specific procedures, MSDSs, and standard chemical references provide the necessary guidance for proper long-term storage and handling of chemicals. The staff of CCMC, Savannah River Technology Center, Industrial Hygiene Department, and Fire Protection Engineering can be reached by the chemical coordinators for consultation on any storage and handling issues.

The onsite warehousing of newly arrived chemicals includes the Central Receiving Facility and MACs. The Central Receiving Facility is used for temporary storage of stock items, bulk orders, and material that will not be consumed soon after delivery. This facility is designed and staffed to store large amounts of material. MACs are small warehouses, which are conveniently located near the facilities to reduce procurement times and increase customer satisfaction. The MACs are designed to accept, store, and issue materials that are quick turnaround items.

2.6 Control of Chemical Hazards

SRS eliminates or mitigates identified hazards through engineered and/or administrative controls. These are incorporated into the design and are specified in facility operating procedures and facility-specific training.

The CCMC administers the SRS HazCom Program, in compliance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the S/RID. All employees have access, via the SRS Intranet, to the site MSDS database, which contains electronic images of MSDSs for products used on site. This open access is important for worker health and safety and satisfies OSHA requirements.

The site HazCom Coordinator is on the CCMC staff and is responsible for all aspects of the HazCom program, including training of chemical coordinators, chemical workers, and general employees. The Industrial Hygiene Department is responsible for supporting work activities involving chemicals by recommending the necessary Personal Protective Equipment, work controls to minimize chemical exposures, and participating in job hazard analyses, as required. The Fire Protection Engineering group is available to provide guidance on the suitability of facilities for storage of chemicals to assure NFPA code compliance and safe segregation between incompatible chemical categories. The Savannah River Technology Center (SRTC) has sections regulated under the OSHA Laboratory Standard, 29 CFR1910.1450. SRTC has a Chemical Hygiene Plan and a Chemical Hygiene Officer, who is matrixed to the CCMC to provide consistent guidance across the site.

Annually, a Special Hazards Report is sent out to all WSRC Divisions to alert them about any self-reactive and time-sensitive chemicals present in their inventories that can become storage hazards (i.e., have the potential to violently degrade, decompose, polymerize or convert to products that may be shock-sensitive, explosive, or toxic). A courtesy reminder is sent after 6 months to all laboratories that have such chemicals. Improper storage can result in serious injuries to workers, property loss, and costly remediation efforts. The Divisions have the responsibility to take necessary actions such as ascertaining the continued viability of these chemicals for future use or making decisions on disposal.

Safety basis documentation identifies bulk chemical storage areas and the potential impact of unmitigated releases from these storage areas with respect to worker safety (onsite release), environment, and the public (offsite release). Conduct of operations, including facility procedures and job hazards analysis, ensures safe use of the bulk chemicals. As an independent check, the facility self-assessment program reviews chemical storage areas for proper storage, chemicals for unlabeled/mislabeled containers, and containers for signs of damage, degradation or leakage. A checklist for self-assessment of chemical storage areas is available sitewide via the Chemical Life Cycle Management homepage on the site Intranet.

With emphasis on continuous improvement, WSRC organizations conduct self-assessments at the facility level. Included in the areas of review are chemical safety and adherence to all elements of the CMP. These periodic reviews result in identification of any facility-specific problems and the implementation of corrective actions. In addition, the WSRC Facility Evaluation Board conducts independent, unannounced performance assessments of facilities and programs at SRS and reports its findings directly to the President of WSRC. Such a site-level management review helps to identify any needed programmatic changes in the CMP. The CCMC manager, being the program owner, coordinates the sitewide review on CMP with the Board.

When chemical releases (e.g., spills) occur in a quantity equal to or exceeding the CERCLA RQs, a hazardous substance release notification in accordance with 40 CFR 302.4 is required. The facility organization reports the incident to the Environmental Protection Department, which communicates the information to appropriate regulatory agencies.

2.7 Pollution Prevention and Waste Minimization

The CCMC strives to reduce the amount of hazardous chemicals and chemical products procured (see Section 2.1), attempts to find nonhazardous substitutes for environmentally unfriendly chemical products, and implements the Excess Chemical Program to minimize potential waste and promote resource reutilization.

The SRS Excess Chemical Program, administered by the CCMC, is designed to accept chemicals and chemical products from those site facilities which have no immediate use for these materials as a result of changes in mission. This program avoids the otherwise costly disposal of chemicals and the generation of hazardous wastes. Most excess chemicals are stored in a central Excess Chemical Warehouse for disbursement to the site facilities, free of charge to the receiving organization. The CCMC keeps the inventory information in a database that requestors and buyers can review before processing a chemical purchase requisition. In the case where a facility's excess chemical inventory is too large, the materials are left in that facility and marketed "in place."

The Excess Chemical Program saves on acquisition costs and provides the needed chemicals to the onsite user in a timely manner. If site organizations do not consume the chemicals within a reasonable time period, then other avenues of disposition are pursued by the CCMC. The chemicals are advertised for donation to another DOE site through the Energy Asset Disposal System (EADS) program;offered for donations to state agencies or charitable organizations through state screening programs; offered for sale on a competitive bid to different companies through the SRS procurement department; sold at a site auction; or, after all other avenues have been exhausted, declared as waste and disposed of in the appropriate manner.

SRS has active programs on waste minimization and pollution prevention for operating facilities. Examples include lead management, ozone depleting substances/refrigerant management, and other programs. SRS prepares annual regulatory reports on Air Emissions Inventory, EPCRA Tier II Annual Chemical Inventory, SARA Section 313 Toxic Chemical Release Inventory, etc. to demonstrate progress in the reduction of hazardous material inventories or releases to the environment**.**

2.8 Emergency Management

SRS has site-level policies and procedures in place to satisfy the Emergency Management program requirements from DOE Order O151.1A, Comprehensive Emergency Management System. The Director of Safeguards, Security and Emergency Services Division manages the Emergency Management Program at SRS.

The Emergency Services Manager is responsible for implementation of the Savannah River Site Emergency Plan, which is a collaborative effort between the DOE-SR, WSRC, and the Site Security contractor. The SRS Emergency Plan lays the foundation for the SRS emergency preparedness program, provides a coordinated approach to emergency response and mitigation at the site, and meets the requirements mandated by law and DOE orders. The Emergency Services manager is also responsible for implementing the Emergency Preparedness Program at SRS and for ensuring that the requirements for emergency responder training, as identified in 29 CFR 1910.120, are met.

The "SRS Emergency Plan" is implemented through the company-level "SRS Emergency Plan Emergency Management Procedures Manual," which establishes sitewide programmatic policies, standards, guidelines and requirements for emergency preparedness.

SRS facilities that contain hazardous materials in quantities that exceed predetermined thresholds will complete the facility Emergency Preparedness Hazards Assessment. These documents are developed and

updated periodically to identify potential hazards, including those due to chemical inventories in facilities located in each area of the site, and to assess the appropriate course of action in response to an incident. This assessment is used to determine the extent and scope of emergency planning and preparedness activities.

Facility/Area Emergency Coordinators and emergency response personnel are responsible for reporting identified events or conditions to the Emergency Duty Officer. These event or conditions are then assessed against specific criteria to determine event categorization.

In the event of a release or an emergency, notifications are made to appropriate offsite regulatory agencies, as required by law (i.e., CERCLA and EPCRA). These contacts may include the National Response Center, South Carolina Emergency Response Commission, South Carolina Emergency Preparedness Division, Georgia Energy Management Agency, the Local Emergency Planning Committee, and the Emergency Management Agencies of local counties. For releases of a regulated substance, the site Environmental Protection Coordinator ensures that the required regulatory notifications are made and performs required follow-up activities for environmental impact-related events.

The site conducts emergency preparedness drills and exercises to evaluate its readiness response to emergencies. An annual emergency drill is held onsite, in conjunction with state and local county emergency responders, as a training exercise to improve inter-agency coordination and communication skills.

2.9 Disposal

Disposition or disposal of chemicals from the end-user facility follows established programs for the disposal of chemicals based on their classification. Examples of different classifications include radioactive wastes, hazardous wastes, mixed wastes, sanitary wastes, and high-level wastes. Chemicals that are not consumed are evaluated by the CCMC for usability. If it is determined that the chemicals are viable and usable, they are declared as excess and accepted into the Excess Chemical Program and are thus made available for use by any organization on site.

Periodically, the CCMC reviews the Excess Chemical Warehouse to assess viability of the products stored and identifies non-viable items for disposal. Excess chemicals for which all redistribution options have been exhausted are also included in this review. The CCMC is responsible for the disposal of all non-viable material from the Excess Chemical Warehouse. Individual site organizations are responsible for the disposal of chemicals, including those determined to be hazardous waste, in accordance with RCRA and state regulations, and site procedures. The Solid Waste Division coordinates waste disposal activities and the Environmental Protection Department provides guidance on waste determination and disposal options.

2.10 Training

All site employees receive initial SRS HazCom training during the General Employee Training, a requirement for all new employees. Every 2 years, all employees receive HazCom refresher training during the Consolidated Annual Training. The facility-specific chemical safety training includes identification of unique hazards posed by the chemicals used, response to spills and leaks, emergency response actions, facility evacuation routes, and other issues. Facility-specific HazCom training for a department or division is developed by the Central Training organization, with input from the CCMC. This ensures a consistent training program across the site. Updated Facility-specific HazCom training is to be taken every 2 years or whenever a new chemical hazard is introduced into the facility.

The chemical coordinators undergo a formal training program, developed by the CCMC, which includes initial training and regular updates and retraining as necessary. All employees have access to a chemical coordinator for their area, and to the Chemical Lifecycle Management homepage on the SRS Intranet, which provides many helpful links to chemical information.

Personnel involved in chemical management activities such as transportation, emergency preparedness/response, and waste disposal in various divisions take specialized training. This training is tailored to their job function and responsibilities and meets the requirements of any applicable Federal (EPA, OSHA, DOT) laws, DOE directives, and the State of South Carolina regulations.

An electronic mailbox has been created for CCMC on SRS Intranet to allow any employee to send in chemical safety questions; it is CCMC's goal to provide answers quickly, usually within a day of receipt of the message. This communication tool focuses on customer service.

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- U.S. Department of Energy, DOE G 440.1-3, "Implementation Guide for use with DOE O 440.1, Occupational Exposure Assessment," March 30, 1998

- U.S. Department of Energy, DOE P 450.4, “Safety Management System Policy,” October 15, 1996
- U.S. Department of Energy, DOE G 450.3-3, “Tailoring for Integrated Safety Management Applications,” February 1, 1997
- U.S. Department of Energy, DOE G 450.4-1A, “Integrated Safety Management System Guide,” May 27, 1999
- U.S. Department of Energy, DOE-STD-1120-98, “Integration of Environment, Safety, and Health into Facility Disposition Activities,” Volume 1 of 2
- U.S. Department of Energy, DOE-STD-3009-94, “Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports”
- U.S. Department of Energy, DOE-STD-5503-94, “EM Health and Safety Plan Guidelines”
- U.S. Department of Energy, DOE-HDBK-3027-99, “Integrated Safety Management Systems (ISMS) Verification Team Leader's Handbook”
- U.S. Department of Energy, DOE/EH-0535, “Handbook for Occupational Health and Safety During Hazardous Waste Activities”

Appendix A

During the 1999 joint DOE/Energy Facility Contractors Group Chemical Safety Workshop, a subgroup was formed to better integrate Chemical Management into the Department's ISM policy. The team, representing both DOE and contractor representatives from across the complex, developed the following sample Lines of Inquiry.

REVIEW CRITERIA AND SAMPLE LINES OF INQUIRY FOR CHEMICAL MANAGEMENT FOCUSING ON CHEMICAL HAZARDS MANAGEMENT

The following provides a collection of lines of inquiry that could be used in an assessment of the chemical management functional area. The lines of inquiry are grouped according to the general criteria for a subject matter expert (SME) evaluation recommended in the Integrated Safety Management System (ISMS) Team Leader's Handbook. These lines of inquiry are suitable for use by a chemical management SME within a broader ISMS review or in a "stand-alone" review of a chemical management program.

The lines of inquiry may be used in reviewing requirements' documentation, interviewing personnel, or observing activities. A robust set of lines of inquiry would enable determination that the given criteria are met.

Members of the Chemical Safety Topical Committee and others with experience in reviews and verifications in this functional area are invited to add to these suggested lines of inquiry, so this collection continues to grow as a valuable resource.

OBJECTIVE

Within the Chemical Management area, the planning of work includes an integrated identification and analysis of hazards, and development and specification of necessary controls. There is an adequate process for the authorization and control of work, and a process for identifying opportunities for feedback and continuous improvement. Within the Chemical Management area, line managers are responsible for safety; clear roles and responsibilities have been established; and there is a satisfactory level of competence.

CRITERIA AND LINES OF INQUIRY

Criterion 1

Procedures and/or mechanisms for activities involving chemicals require adequate planning of individual work items to ensure that hazards are identified and analyzed, and that appropriate controls are identified and selected for subsequent implementation.

Lines of Inquiry

- What is the process used to identify potentially hazardous chemicals that are used or stored in the facility? What hazard analyses are conducted for such chemicals and for chemical processes in the facility? What is the "driver" for these hazard analyses?

- What are the qualifications of personnel performing chemical hazard analysis? Are "hands-on" employees involved in all chemical hazard analyses conducted by SMEs? Do environment, safety and health (ES&H) professionals conduct walk-downs of facilities in which chemicals are to be used or stored, prior to completing the hazard analysis?

- Do the work packages reflect a well-developed planning process that incorporates potential chemical safety concerns?

- Has the facility adequately implemented a job hazard analysis procedure for work planning? Is chemical safety integrated into this process? Is identification (and reduction) of waste generation integrated into this process?

- Are there procedures or instructions in place to specify when review and approval are needed on project documentation to ensure that any chemical hazards management concerns are addressed?

- Does a facility-specific procedure exist to implement a comprehensive chemical hazard management program? Does it reflect site-wide requirements and all applicable standards?

- Are waste types, quantities, and their associated hazards identified in the job hazard analysis and work planning process?

- Are hazards of legacy chemicals (e.g., abandoned, residual chemicals in tanks and pipes with inadequate controls) properly identified and addressed? Have their potentially degraded storage conditions been considered? Have these chemicals been sampled and characterized? Are there adequate controls to prevent and mitigate adverse consequences? Are the containers of these chemicals periodically inspected and maintained? Are the hazards of these chemicals appropriately and sufficiently addressed in the facility's safety basis?

- What is the regulatory status of the legacy chemicals in the facility? Has the regulatory status of the legacy chemicals as hazardous waste been appropriately determined?

- Has pollution prevention (substitution with a non-hazardous material or reduction in quantity used) been considered, when applicable, as a way to prevent or mitigate chemical hazards?

- Are adequate and appropriate controls for chemical hazards identified through the hazard analysis? Are adequate controls identified for all chemical hazards? Are engineered controls preferred over administrative controls? Are administrative controls preferred over personal protective equipment? Are passive controls preferred over active controls?

- Are hazard assessments essential to emergency response established and maintained?

Criterion 2

Procedures and/or mechanisms for the acquisition, storage, use, and disposal of chemicals contain clear roles and responsibilities. Chemical management is effectively integrated with line support managers to ensure that line managers are responsible for chemical management.

Lines of Inquiry

- Are the responsibilities of line management for chemical safety and chemical management clearly defined, documented, and understood?

- Are the roles and responsibilities of support staff and other personnel associated with the facility's chemical management program/system clearly defined, documented, and understood? Have the primary and secondary points of contacts been identified?

- Are the roles and responsibilities of personnel providing chemical safety expertise and support properly integrated with the line management's responsibilities relative to operations?

- Who is responsible for controlling the hazards arising from chemical storage and use in the workplace? How are they held accountable?

- What processes are in place to ensure adequate input by ES&H and other appropriate professionals in the designation of controls for chemical hazards, and in how they are implemented?

- Are the resources needed for providing an adequate level of chemical safety and management support being communicated to the line management? Is management responsive to the resource needs and concerns identified by ES&H and other appropriate professionals?

Criterion 3

Procedures and/or mechanisms for the acquisition, storage, use, and disposal of chemicals require selected controls to be implemented, that those controls are effectively integrated, and that their readiness is confirmed prior to the performance of work.

Lines of Inquiry

- Do facility and warehouse control procedures properly implement chemical management procedures to ensure safe handling and storage of chemicals?

- Is prevention and source reduction of hazardous materials supported by appropriate procurement and inventory practices?

- Is the chemical inventory at a given storage location being properly updated as the inventory changes? Is the inventory inspection and surveillance conducted at an appropriate frequency? Do all chemical storage areas receive adequate coverage through periodic surveillance?

- Is a database or hardcopy file maintained of Material Safety Data Sheets (MSDS) for chemicals used and stored at the work-site and at the facility? How is access to MSDS information provided to workers?

- Is there a procedure that ensures that chemicals stored in a given location are compatible? Is it adequately implemented?

- What criteria are used to select appropriate standards and requirements (e.g., Work Smart Standards, Standards/Requirements Identification Documents, or others, as applicable) to address all chemical hazards? What are the qualifications of individuals performing standards selection?

- What processes are in place to ensure adequate input by ES&H professionals in the implementation of controls for chemical hazards?

- What is the process for authorizing a chemical to be used on the site? What pollution prevention practices are conducted at the site? Is there a list of restricted chemicals? How is chemical storage and use policed? How are excess or waste chemicals disposed of? What processes are in place to assure chemicals are not abandoned when work on a project ceases?

- What means are employed to ensure that the identified controls are implemented, and are operable and functioning so long as a chemical hazard is present?

- Is personal protective equipment required to be used for any activity involving hazardous chemicals? Has substitution of a less hazardous chemical been considered? Are engineering controls in place or planned for these operations? What other controls or measures are in place for these operations?

- When and how is a decision made to evaluate employee exposure to a chemical hazard? What is management's role in assuring that chemical exposures are evaluated and properly addressed?

- How does your occupational medicine group become aware of chemical usage and employee exposure to specific chemicals? What are their roles and responsibilities once an employee's exposure has been demonstrated?

- Are changes to mission, operations, and conditions analyzed for needed changes to requirements? How are ES&H personnel involved in this process?

Criterion 4

Procedures and/or mechanisms for acquisition, storage, use, and disposal of chemicals require that personnel who are assigned to the subject area have a satisfactory level of competence.

Lines of Inquiry

- What training is provided to employees on the hazards of chemicals and chemical processes they work with, and on the controls that are most appropriate for those hazards? How frequently is this training provided? Is this training kept current? What is the frequency of refresher training provided for affected employees? Is training effectiveness measured? If so, how?

- What training is provided to supervisors and managers on management of hazards arising from chemical storage and use?

- Are requests for assistance and documents for information or review distributed to appropriately qualified and knowledgeable staff?

- Are chemical safety support staff sufficiently familiar with facility operations? Do they participate in routine inspections, assessments, and audits; in training; and in the categorization, analysis and development of corrective actions for occurrences?

- Do they participate in overseeing the implementation of selected controls and in followup inspections of those controls?

- Are the managers, supervisors, and support staff sufficiently knowledgeable about pollution prevention and waste minimization (prevention and source reduction of hazardous materials), such that these are incorporated into their chemical hazard prevention and mitigation activities?

- Does the organization (internal or subcontractor) responsible for providing chemical safety support use a training implementation plan to manage staff training and qualifications?

- Do position descriptions for points-of-contact or coordinators responsible for chemical hazards management appropriately reflect their duties and responsibilities relative to chemical safety, as well as their training and subject matter competency?

Criterion 5

Procedures and/or mechanisms require that feedback and continuous improvement occur with regard to chemical management, chemical safety, and pollution prevention.

Lines of Inquiry

- Has the facility performed an assessment and gap analysis to identify significant gaps and deficiencies in its program? Does the facility maintain its corrective action plan up-to-date? Are the action items prioritized? Have the corrective actions completed been properly closed? Are open items being pursued according to their priority?

- Do post-job critiques and reviews reveal that chemical safety concerns were adequately handled, or if identified, they were adequately pursued and resolved? Is there evidence showing that lessons learned are properly used to improve work conditions or performance?

- Are assessment results communicated to senior management for their use in making informed determinations? Do managers routinely use feedback tools, such as performance indicators, reviews, debriefs, and lessons learned?

- Are occurrence reports evaluated for applicability and communicated to the right individuals?

- Are suggestions of employees and other professionals used to improve performance?

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Appendix B

LESSONS LEARNED

The following lessons learned are extracted from DOE Operating Experience (OE) Weekly Summary and Occurrence Reporting and Processing System (ORPS) reports and are included in this Appendix as potential learning and training tools for the reader.

Safe storage of chemicals.

- Students discovered a cylinder containing hydrogen fluoride (HF) that had ruptured inside a storage room next to a laboratory. Following the cylinder failure, investigators learned of a letter DuPont Fluoroproducts sent to its customers two and a half years earlier about the potential over-pressure hazard associated with the long-term storage of Anhydrous HF in carbon steel cylinders. The cylinder was a lecture bottle that had been stored at the university for 22 years. (OE Weekly Summary 99-25)

- Three reactor auxiliary operators were exposed to trimethylamine above the short-term (15-minute) exposure limit while recharging an ion exchange resin in a demineralizer tank. Investigators believe that the excessive off-gassing of trimethylamine resulted from the drums of resin being stored at a higher temperature than that recommended on the MSDS. (ORPS Report ID--LITC-ATR-1998-0014)

- Facility chemists found five sealed containers of lithium metal stored inside a nitrogen glove box instead of an adjacent argon glove box. Lithium reacts with nitrogen and can result in highly exothermic reactions when exposed to water or oxygen. (ORPS Report ID--LITC-ERATOWNFAC-1998)

- A cleaning subcontractor employee became nauseous and vomited while spraying a chemical cleaner in a restroom in the administration building. Investigators determined that the spray bottle was mislabeled "Crew," which is a chemical manufactured for cleaning toilet bowls and sinks. The label did bear the manufacturer's warnings, but the bottle actually contained nearly full strength Lysol liquid cleaner. (ORPS Report ORO--MK-WSSRAP-1998-0040)

- A maintenance crew discovered a small vial labeled "picric acid" in a crawl space while they were performing a pre-job walk-down for maintenance on some steam lines. Picric acid is normally used as an aqueous solution and an explosive mixture results when the solution crystallizes. Eight similar occurrences involving picric acid were found dating back to 1990. In these events, explosive safety specialists removed the acid and either chemically neutralized it or detonated it in a safe area. (OE Weekly Summary 98-05)

Inadequate control of chemical hazards.

- The Type A investigation of a sodium potassium (NaK) accident that occurred at the Y-12 plant on December 8, 1999, identified a lack of understanding of the hazard from NaK and its reactive by-products as one of the root causes of the accident. The investigation found that personnel involved in planning the task, the safety documentation for the facility, the procedure for the task, and the procedures supporting hazard identification and analysis did not address the complete NaK hazard.

The investigation also determined that detailed hazard identification data supported by accident analysis and appropriate control information was readily available.

Training. These events underscore the importance for chemical worker training to include hazard information and lessons learned from accidents, previous studies, and similar events involving the same chemicals and chemical work practices

- A chemical tank explosion caused significant localized damage to a facility. Personnel failed to recognize the phenomenon that was being created inside the tank. Concentration by evaporation of a dilute solution of hydroxylamine nitrate and nitric acid occurred to the point where an autocatalytic reaction created a rapid gas evolution that over-pressurized the tank beyond its physical design limitations. Similar hazards were identified as early as 1970, and reports of various accidents were available to the facility. However, these hazards were not included in training and qualification programs to heighten awareness of the chemical hazards. (ORPS Report RL--PHMC-PFP-1997-0023, Final Report 05-17-99)

- An explosion occurred when a chemical operator performing lithium hydride recovery operations submerged a high-efficiency particulate air (HEPA) filter embedded with lithium hydride residue into a salvage vat containing demineralized water. Lithium hydride reacts exothermically with water to form caustic lithium hydroxide and flammable hydrogen gas. The exothermic reaction produced enough heat to begin burning the filter's wood framing, even though the filter was submerged. Investigators believe that oxygen from air trapped in the filter combined with the hydrogen generated from the reaction caused the explosion. Investigators also determined that it had once been a skill-of-the-craft practice to perforate a filter with holes before cleaning to more efficiently liberate entrapped air and hydrogen during the reaction. This past practice had been lost over time, owing to the attrition of experienced operators, and had not been captured in the procedure for cleaning the filters. (ORPS Report ORO--LMES-Y12NUCLEAR-1999-0031)

- A high-pressure carbon dioxide (CO2) fire suppression system unexpectedly actuated, resulting in one fatality, several life-threatening injuries, and significant risk to the safety of the initial rescuers. Investigators determined the inadvertent operation of electric control heads released CO2 into the occupied space without a discharge warning alarm. In addition, the CO2 system was not physically locked out as was required. The procedure that required this barrier had not been updated or used for this work. The requirement to train workers in the hazards of emergency response to CO2 discharges had not been incorporated into training programs. A contributing cause for the accident was the failure to take corrective actions and apply lessons learned from previous accident investigations, particularly in work planning and control. (ORPS Report ID--LITC-TRA-1998-0010)

- A subcontractor employee was sprayed with acid when he inserted a hydrochloric acid pump into a drum of sulfuric acid. When the two acids mixed, a violent chemical reaction caused acid to be sprayed from the drum approximately 10 feet to the ceiling and onto the employee. (ORPS Report ORO--MK-WSSRAP-1999-0004)

- A technician working in a laboratory discovered a ruptured 1-liter polyethylene bottle of acid on the floor of a chemical hood. Laboratory personnel had heated it to approximately 140 degrees, capped it, and placed it in the hood to cool down. Chemists believe that off-gassing of the acid mixture at an elevated temperature built up sufficient pressure to rupture the bottle. (ORPS Report SR--WSRC-FSD-1998-0004)

- Hazardous waste workers discovered a ruptured 1-liter glass bottle labeled "Used Nitric Acid" in a waste room. Investigators determined that the unvented bottle had accumulated pressure over time, causing it to burst. (ORPS Report CH-BH-BNL-NSLS-1996-0002)

- A building was evacuated due to fumes generated by mixing a solution of nitric acid, hydrogen fluoride, and acetic acid with a solution of ethanol, hydrofluoric acid, and water. Investigators determined that the fumes resulted from a reaction between incompatible materials being mixed for waste disposal by a technician. (ORPS Report SAN--LLNL-LLNL-1997-0037)

- A researcher was adding methanol to two vials containing sodium permanganate and polychlorinated biphenyls when an unexpected energetic reaction caused the mixture to spray from the vials and onto the researcher's gloves. Investigators determined that there was an inadequate evaluation of chemical compatibility. (ORPS Report ORO--ORNL-X10ENVIOSC-1996-0001)

- Personnel who responded to a chemical spill of methyl acrylate were never briefed by facility personnel. As a result, they did not assume command of the event, even though facility procedures require the command to be transferred to Emergency Management and Response (EM&R) if the facility does not have adequate resources to handle an event. The fact that the facility called for the hazardous materials (HAZMAT) team and used the services of occupational medicine was a sign that it did not have the necessary personnel to deal with the event, so EM&R should have assumed the role of incident commander. Furthermore, no one was concerned about the flammability of the chemical. No one called the fire department to respond as a precautionary measure. If the methyl acrylate had ignited, a fire could have quickly spread through the rest of the lab. Also, if a fire had occurred when the spill response team entered the room, they could have been severely burned. (ORPS Report ALO-LA-LANL-TA55-1999-0032)

- During a chlorine leak, the emergency response team was not totally familiar with the facility systems. Plant operators had to tell them how to isolate chlorine cylinders and how to reset alarms to determine if they were still detecting chlorine. (ORPS Report RL--PHMC-S&W-1999- 0002)

- A researcher did not immediately notify his manager or emergency response personnel after a vessel ruptured and expelled a mixture of 130 degrees centigrade trichloroethylene and hydrogen peroxide from the face of a fume hood. (ORPS Report RL--PHMC-PNNLBOPER-1998- 0022)

- Facility personnel waited approximately 30 minutes before reporting a 2-gallon spill of radioactive phosphoric acid. Also, personnel in the spill area did not observe restrictions on eating, drinking, and smoking, and some workers assisted emergency operations personnel without wearing personal protective equipment. (ORPS Report RFO--KHLL-LIQWASTE-1998-0002)

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Appendix C

PROGRAM RESOURCES

The following list of program resources is not intended to be a comprehensive list (no list can be), however it does provide useful references most of which can be accessed via the internet. This list will be updated and additional resources will be added to the electronic version of this document available on EH-5's Chemical Management Web Site (http://www.eh.doe.gov/web/chem_safety/).

Hazard Analysis

DOE G 440.1-3, "Occupational Exposure Assessment"
http://www.explorer.doe.gov:1776/pdfs/doe/doetext/neword/440/g4401-3.pdf

EPA Guidelines for Exposure Assessment (Federal Register Vol. 57. No 104. May 29, 1992)
http://www.epa.gov/ncea/exposure.htm

American Industrial Hygiene Association White Paper On A Generic Exposure Assessment Standard
http://www.aiha.org/papers/exposure.html

National Institutes of Health National Institute of Environmental Health Sciences Chemical Health & Safety Data
http://ntp-server.niehs.nih.gov/Main_Pages/Chem-HS.html

National Institute for Occupational Safety and Health (NIOSH) Databases offer online chemical-specific safety, emergency response, and medical surveillance information
http://www.cdc.gov/niosh/database.html

Acquisition

Bechtel Hanford Incorporated (BHI), BHI-01248, Chemical Management Plan

Savannah River Site (SRS) Chemical Management Program, AID-AMS-99-0052, September 3, 1999

Inventory and Tracking

The following are a sampling of computerized inventory and tracking systems across the complex:

- Sandia National Laboratory (SNL) Cradle-to-Grave Tracking and Information System (CGTIS)
- Brookhaven National Laboratory (BNL) Standards-Based Management System (SBMS)
- Pacific Northwest National Laboratory (PNNL) SBMS
- Los Alamos National Laboratory Automated Chemical Inventory System (ACIS)
- National Renewable Energy Laboratory Chemical Inventory System (modified from PNNL)
- Oak Ridge Hazardous Materials Information System (HMIS)

Transportation

DOT Emergency Response Guidebook (ERG2000)

http://hazmat.dot.gov/gydebook.htm

Storage

ES&H Bulletin EH-91-2, "Safe Chemical Storage"

http://www.eh.doe.gov/docs/bull/bull0062.html

National Oceanic and Atmospheric Administration – "The Chemical Reactivity Worksheet"

http://response.restoration.noaa.gov/chemaids/react.html

Texas A&M College of Science "Safe Storage of Laboratory Chemicals"

http://www.science.tamu.edu/safety/chemstorage.html

Control

DOE-STD-5503-94, "EM Health and Safety Plan Guidelines

http://www.eh.doe.gov/techstds/standard/est5503/est5503.pdf

Handbook for Occupational Health and Safety During Hazardous Waste Activities

http://www.eh.doe.gov/docs/haz_waste_activity_handbook/hwa_handbook.html

Pollution Prevention and Waste Minimization

Applicable pollution prevention regulations/policies and other useful information may be found at DOE's Pollution Prevention Clearinghouse at

http://epic.er.doe.gov/epic/

DOE Pollution Prevention Team (EM-22)

http://twilight.saic.com/wastemin/default.asp

ChemAlliance Pollution Prevention

http://www.chemalliance.org/RegTools/links/index.asp

Project list for the U.S. EPA - Office of Research and Development

http://www.pprc.org/pprc/rpd/fedfund/epa/epastd/

EPA Waste Minimization National Plan

http://www.epa.gov/epaoswer/hazwaste/minimize/

EPA Waste Minimization Documents

http://www.epa.gov/epaoswer/hazwaste/minimize/p2.htm

Pacific Northwest Pollution Prevention Resource Center

http://www.pprc.org/pprc/

Emergency Management

EH-2 Emergency Management Evaluation Vols. 1 and 2

http://tis.eh.doe.gov/iopa/reports/emevals/9808eval/em-vol1.pdf

http://tis.eh.doe.gov/iopa/reports/emevals/9808eval/em-vol2.pdf

The Federal Emergency Management Information System (FEMIS©), developed at PNNL, provides planning, coordination, response, and exercise support for emergency management.

http://www.pnl.gov/femis/

Atmospheric Release Advisory Capability (ARAC-3) Modeling System developed at Nevada Test Site is an emergency response system.

http://www-ep.es.llnl.gov/www-ep/atm/ARAC/links.html

National Safety Council (NSC) Emergency Management Resources

http://www.crossroads.nsc.org/emerg_manag.cfm

Computer-Aided Management of Emergency Operations (CAMEO®) helps emergency managers plan for and mitigate chemical accidents and comply with requirements under the Superfund Amendments and Reauthorization Act (SARA) Title III.

http://www.nsc.org/ehc/cameo.htm

Mapping Applications for Response and Planning of Local Operational Tasks (MARPLOT®) allows users to search and display roadways, street addresses, waterways, railroads, census blocks, and other political boundaries.

http://www.nrt.org/nrt/hazmat2000/hazmat2000.nsf/pages/625.html

Agency for Toxic Substances and Disease Registry's (ATSDR) Hazardous Substance Release/Health Effects Database provides access to information on the release of hazardous substances from Superfund sites or from emergency events and on the effects of hazardous substances on the health of human populations.

http://www.atsdr.cdc.gov/hazdat.html

CHEMTREC is a source for hazardous materials/dangerous goods information and communication.

http://www.cmahq.com/cmawebsite.nsf/pages/chemtrec

NSC Environmental Health Center provides emergency response information on specific chemicals as well as additional links.

http://www.nsc.org/ehc/chemical.htm

Risk Management Plans (RMP) from Right to Know Environmental Databases - Under the Clean Air Act Amendments of 1990, certain chemical facilities must report RMPs to prevent and respond to chemical accidents in the United States.

http://www.rtk.net/aboutrmp.html

RMP*InfoTM - displays Risk Management Plans submitted by facilities under Section 112(r) of the Clean Air Act that include information about Risk Management Programs implemented to prevent and prepare for chemical accidents.

http://www.epa.gov:9966/srmpdcd/owa/overview$.startup

Disposal

RCRA Orientation for Facility Managers (Computer Automated Guidance), Version 1.0, September 1998. (See "Training")

http://tis.eh.doe.gov/oepa

Definitions of Solid and Hazardous Wastes (Computer Automated Guidance), Version 1.0, April 1997. (See "Tools")

http://tis.eh.doe.gov/oepa

RCRA Guidance Manuals (See "Policy & Guidance")

http://tis.eh.doe.gov/oepa

RCRA and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Information Office of Environmental Policy and Guidance Publications List - RCRA/CERCLA Division (EH-413)

http://tis.eh.doe.gov/oepa/guidance/publist.pdf

EPA Office of Solid Waste Materials

http://www.epa.gov/epaoswer/osw/publicat.htm

Identifying Your Waste: The Starting Point, EPA530-F-97-029, September 1997.

http://www.epa.gov/epaoswer/osw/mbodyi.htm

RCRA Orientation Manual, EPA530-R-98-004, May 1998.

http://www.epa.gov/ncepihom/Catalog/EPA530R98004.html

Training

OSHA 2254, "Training Requirements in OSHA Standards and Training Guidelines" (revised 1995)

http://www.osha-slc.gov/Publications/osha2254.pdf

Addendum

http://www.osha-slc.gov/Publications/2254addendum.pdf

Voluntary Training Guidelines; Issuance of Revised Training Guidelines - 49:30290

http://www.osha-slc.gov/FedReg_osha_data/FED19840727.html

Training Requirements in OSHA Construction Industry Standards and Training Guidelines

http://www.osha-slc.gov/doc/outreachtraining/htmlfiles/osha2254.html

DOE National Environmental Training Office (NETO) Training on Pollution Prevention Opportunity Assessment

http://www.em.doe.gov/neto/index.html

CONCLUDING MATERIAL

Review Activity:

DOE

DP, EH, EM, NE, SC

Operations Offices

ID, OAK, ORO, RL

National Laboratories

PNNL

Area Offices

External Agency

DNFSB

Preparing Activity:

DOE-EH-52

Project Number:

SAFT-0083