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(Volume 1 of 2)

DOE STANDARD

INTEGRATION OF SAFETY AND HEALTH INTO FACILITY DISPOSITION ACTIVITIES

Volume One: Technical Standard

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Washington, D.C. 20585

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FOREWORD

The Department of Energy (DOE) is experiencing a rapid transition from a weapons-production mission to one with a stronger focus on environmental management that includes surplus facility disposition (deactivation, long-term surveillance and maintenance, and decommissioning or "D&D"); site remediation; and management of radioactive, hazardous, and mixed waste. Coinciding with this mission transition and the enormous environmental management task is the significant reduction of the Department's Federal and contractor workforce. Safe and efficient environmental management activities require addressing and overcoming these and many other challenges, including technological limitations, regulatory compliance, stakeholder and local community needs and priorities, and workforce retraining.

Facility Disposition Safety and Health Challenges

The Department's facility disposition experience achieved over the past few years indicates there are several key issues that impede the effectiveness of worker and public safety and health programs. Principal among these challenges are the following:

1. The existing set of safety and health (S&H) directives were promulgated primarily for the design and operation of DOE facilities. Although fundamental S&H principles and objectives are similar for both facility operation and disposition activities, facility disposition activities have unique work, hazard, and programmatic characteristics that require clarifying or modifying existing directives and requirements. Because facility disposition activities are unique in nature, the application of operation-oriented directives, as well as imposition of external regulations, has often led to the existence of gaps and redundant, overlapping requirements and has created a confusing regulatory environment.

2. Facility disposition activities involve the performance of unique work activities that have introduced new hazards and programmatic challenges seldom encountered by DOE and its contractors during facility operations. These activities can involve potential exposure to a multiplicity of hazards, many of which are initially unknown or unforeseen. The uncharacterized nature of hazards and other uncertainties represents the most dangerous aspect of this work. During a typical facility disposition activity, workers can be exposed to physical (industrial), chemical, radiological, and biological hazards. Effectively addressing these predominately work-related hazards requires strong management and worker commitment to (1) increase worker

awareness and training to enhance hazard recognition skills and (2) implement an effective and integrated hazards management system to identify, analyze, and establish controls for all hazards.

3. The Department's contracting approach to performing facility disposition activities involves reliance on a multitude of subcontractors responsible for completion of defined, often short-term, tasks and scopes of work (e.g., Management and Integration contracts). This approach, coupled with increased reliance on privatization and fixed-cost type contracts, introduces unique challenges for ensuring the safety and health of short-term or transient workers, managing subcontractor activities, and effectively integrating and blending diverse corporate safety cultures.

The following table summarizes the facility disposition characteristics and compares them to those of facility operation.

	Disposition	**Operation**
S&H Regulatory Framework	Categorized by hazard types and clarified by this Technical Standard	Established by existing DOE directives and external regulations
Hazard Profile	Frequently changing; not well-characterized; more unrecognized hazards	Stable; well-characterized
Work Planning	Task or job oriented; frequently performing new, first of a kind tasks, one time and short duration tasks	Routine; focused on operation and maintenance
Hazards Analysis	Dynamic; mainly task-oriented	Operation oriented; generally stable
Workforce Experience	New mission; limited experience; subcontractors may not have process knowledge of facility operations	Familiar with facility operation and routine work
Contract Management	More short-term subcontractor involvement	Contractor managed and operated

With these challenges lying ahead, this Technical Standard focuses on facility disposition activities by providing guidance and recommended cost-effective approaches to ensure that the health and safety of the workforce and the public is an integral and visible element of all Departmental facility disposition activities.

TABLE OF CONTENTS

Volume One

Figures

Tables

Volume 2

1.0 INTRODUCTION

The objective of this Department of Energy (DOE) Technical Standard (the *Standard*) is to provide guidance for integrating and enhancing worker and public safety during facility disposition activities. This standard provides supplemental information for integrating project management requirements and associated guidelines contained within DOE O 430.1, Life-Cycle Asset Management (LCAM) and amplified within the three associated Implementation Guides (i.e., DOE G 430.1-2, *Surveillance and Maintenance During Facility Disposition Implementation Guide,* DOE G 430.1-3, *Deactivation Implementation Guide,* and DOE G 430.1-4, *Decommissioning Implementation Guide*) with safety and health considerations.

In addition, the *Standard* is designed to support an Integrated Safety Management System (ISMS), consistent with the guiding principles contained in DOE P 450.4, *Safety Management System Policy*, and discussed in DOE G 450.4-1, *Integrated Safety Management System Guide*. The ISMS guiding principles are the fundamental policies that guide safe accomplishment of work and include: (1) line management responsibility for safety; (2) clear roles and responsibilities; (3) competence commensurate with responsibilities; (4) balanced priorities; (5) identification of safety standards and requirements, (6) hazard controls tailored to work being performed, and (7) operations authorization. This *Standard* specifically addresses implementation of ISMS principles four through seven[1], as applied to facility disposition activities, and contains the following:

- directives implementation guidance to help clarify, integrate, and reduce overlapping and operationally oriented safety and health (S&H) requirements applicable to facility disposition activities
- safety management guidance that provides an integrated and balanced approach to identification, analysis, and control of all hazards (radiological, physical, chemical, and biological)
- recommended S&H performance expectations for implementing an effective facility disposition ISMS, including those expectations related to subcontractor and transient workers
- a roadmap of existing S&H directives, potentially applicable to facility disposition activities, organized by hazard types (i.e., radiological, physical, chemical, and biological)

[1]The guiding principles that are not specifically addressed in this *Standard* (i.e., line management responsibility for safety, clear roles and responsibilities, competence commensurate with responsibilities) are further discussed in DOE G 450.4-1, *Integrated Safety Management System Guide* and DOE M 411.1, *Department of Energy Manual for Safety Management Functions, Responsibilities, and Authorities.*

Table 1 provides a convenient reference for locating selected topics contained within the *Standard*.

It is recognized that an effective ISMS should also integrate activities related to environmental protection; however, this *Standard* focuses primarily on S&H. Environmental protection has been addressed in other Office of Environmental Management (EM) and Office of Environment, Safety and Health.(EH) directives and guidance. Project managers are encouraged to integrate these requirements into their ISMS.

Table 1. Key DOE-STD-1120-98 Topics

S&H RELATED TOPICS	SECTION
CERCLA/S&H Integration	3.1.1
Facility Disposition Phases and Hazards	2.0
Facility Baseline Assessment	3.2.1
Facility Classifications	3.3.4
Hazard Analysis Techniques	Appendix E
Hazard Characterization	3.1.3
Hazard Categorization	3.1.4, 3.3.4, 3.4.1
Health and Safety Plans	3.1.3, Table 2, 3.3.4
Integrated Hazard Analysis	3.2
Job Hazard Analysis	3.2.2
Management Plans	3.1.1
Management of Change	3.4.2
Multidisciplined Work Teams (Worker Involvement)	3.1.3, 3.2.1, 3.2.2
Natural Phenomena Hazards	3.2.1, 3.3.2
Readiness Reviews	3.4.1
Resource Planning	3.1.2
Retirement of Facility Safety Controls	3.3.2
S&H Requirements Identification	3.1.4, Appendix A
S&H Performance Expectations	Appendix C
Safety Analysis Reports	3.1.4, 3.3.4, Table 2
Subcontractor S&H Activities	3.1.1
Use of Existing Hazard Baseline Documentation	3.3.5
Work Smart Standards Process	Appendix B
Work Packages	3.2.2, 3.3.1
Worker Safety Controls	3.3.1

1.1 Applicability

The S&H principles presented in this *Standard* apply to all facilities through all phases of facility disposition; that is, deactivation, long-term surveillance and maintenance (S&M), and decommissioning. Additionally, this *Standard* is intended for use by facility disposition project teams consisting of project managers, safety and health professionals, engineers, supervisors, and workers. The principles contained within this *Standard* may be also useful for individuals that are tasked with performing environmental restoration activities or engaged in processing materials for stabilization; however, this *Standard* is not specifically intended for these types of activities.

Guidance contained within this *Standard* may also be useful to teams implementing the DOE Work Smart Standards (WSS) process, as well as those teams following a compliance based approach using a Standards/Requirements Identification Document (S/RID) process. Throughout the *Standard*, multiple clarifications of directives are provided. In addition, Appendix A provides a set of candidate S&H directives. Together, this guidance helps determine applicability of directives to facility disposition activities. Additional information on WSS, including an overall summary of the process, is provided in Appendix B, "Overview of Work Smart Standards Process."

1.2 Organization

The *Standard* consists of two volumes. Volume 1 has three chapters, including this introductory chapter. Chapter 2 provides an overview of specific facility disposition phases, a typical hazard profile for each phase, and associated regulatory considerations. Chapter 3 is organized around the five ISMS core functions described in DOE P 450.4 as implemented at both the facility and task level. Figure 1 provides an illustration of these core functions. Chapter 3 also provides recommendations for addressing major implementation issues related to existing S&H directives.

Volume 2 contains the appendices that provide additional S&H information in support of the *Standard*. Appendix A provides a compilation of existing S&H directives and external regulations, organized by hazard types, that can be used as the starting point for developing a set of specific facility/activity S&H requirements. Appendix B provides an overview of the WSS process. Appendix C provides S&H performance expectations to guide a project team in developing and implementing an effective ISMS. Appendix D provides examples and lessons learned that illustrate implementation of S&H approaches discussed in Chapter 3 of Volume 1. Appendix E provides information on available hazard analysis techniques and references, and Appendix F provides a sample readiness review checklist.

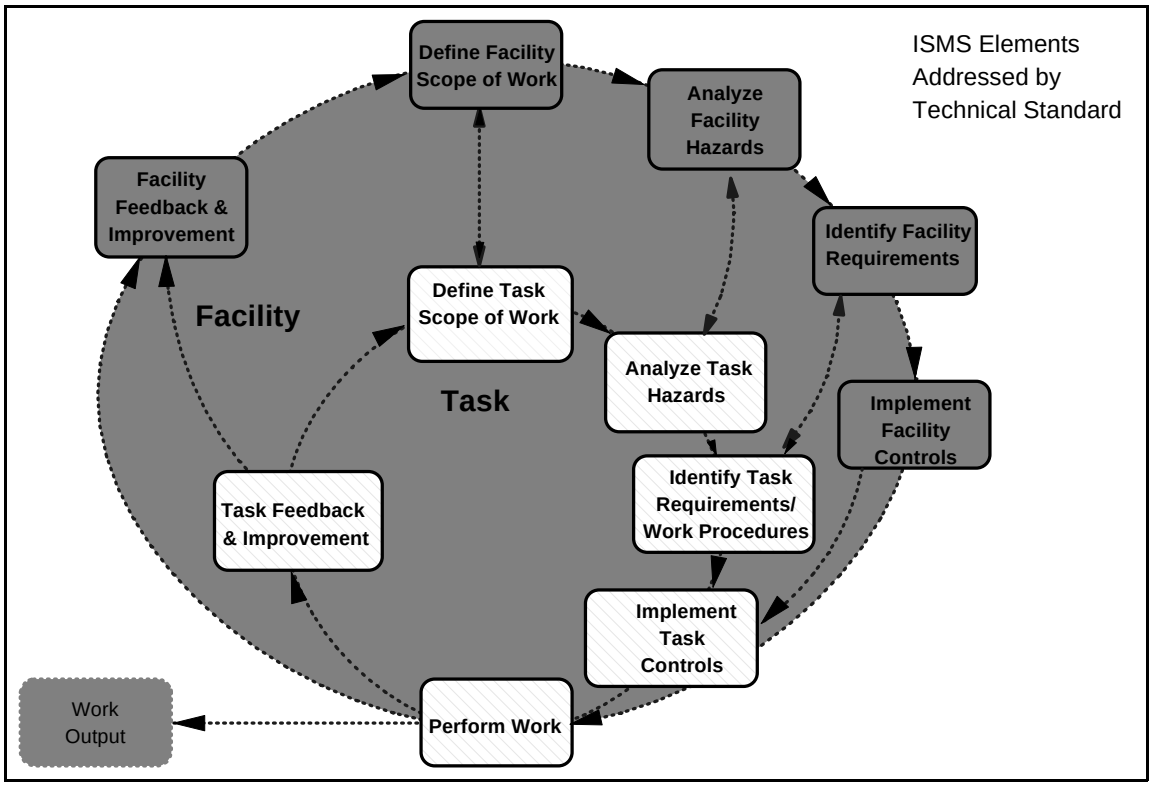

Figure 1. Integrated Safety Management System (ISMS)

2.0 FACILITY DISPOSITION PHASES

The various phases of facility disposition (deactivation, long-term S&M, and decommissioning) have differing work objectives, desired end-points, and associated hazards that determine the set of requirements necessary to protect the S&H of the workers and the public. Ideally, facility disposition activities begin with deactivation immediately after operation with the stabilization and removal of a surplus facility's hazardous materials (see Scenario 1 in Figure 2). Decommissioning activities follow deactivation. These activities include removing contamination and residual hazardous materials and reusing or dismantling facility systems and physical structures. Both deactivation and decommissioning may also include S&M tasks as part of the overall project activities.

Not all facility disposition activities follow Scenario 1. Often, a period of long-term S&M is conducted between facility operation, deactivation, and decommissioning. These long-term S&M activities focus on monitoring and controlling any remaining hazardous materials or contamination and maintaining the structural integrity of the facility. In some cases, operations at a facility may be suspended on a temporary basis, then the shutdown is extended indefinitely. (In effect, the facility has entered an S&M phase by default.) Several realistic facility disposition scenarios are presented in Figure 2, along with

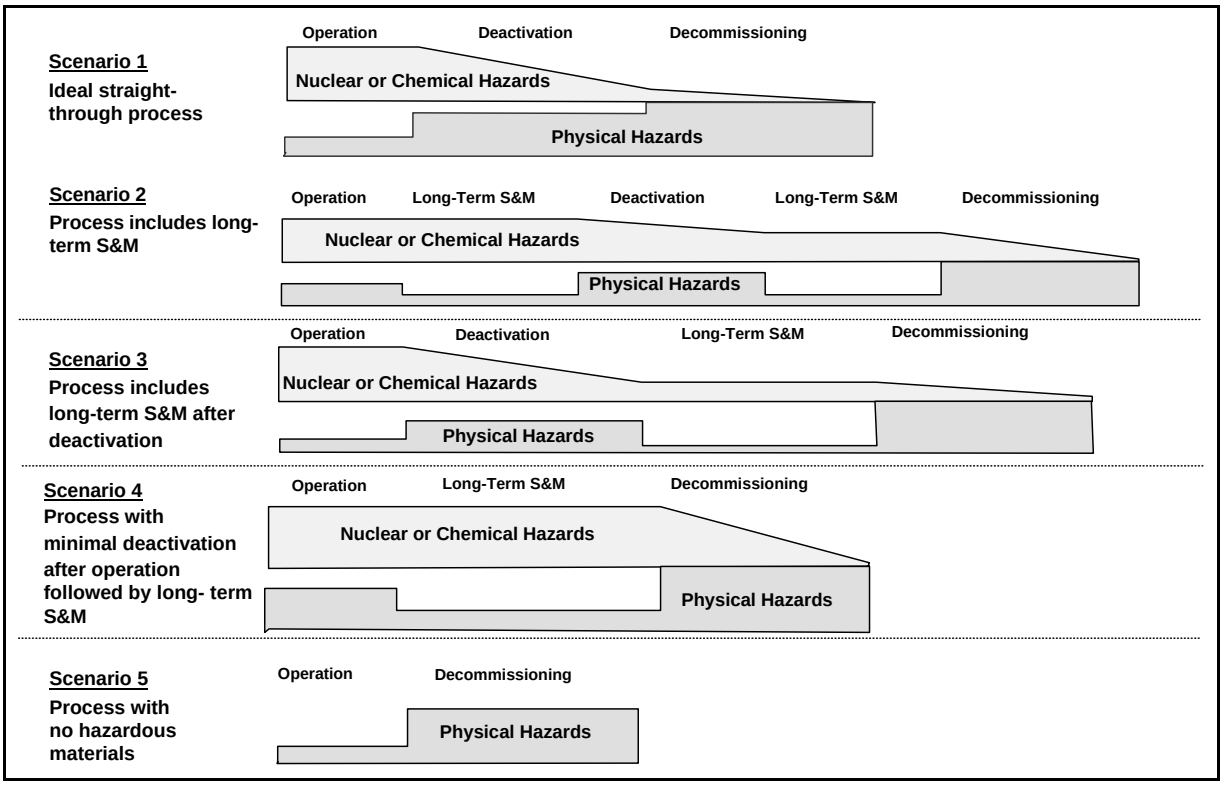

Figure 2. Facility Disposition Scenarios and Associated Hazard Profiles

Scenario 1. More detailed definitions of the three facility disposition phases can be found in the EM *Decommissioning Resource Guide*. The time spent in each facility disposition phase generally depends on the magnitude of hazards, complexity of the project, and availability of project funding. As radiological or hazardous material inventories are removed, potential risks to the public and environment are eventually reduced. However, risk to workers may increase from potential exposure to both radiological and hazardous materials during removal. Also, workers are exposed to more physical hazards, similar to those encountered during typical construction activities, as indicated by the disposition hazard profiles in Figure 2. It is important to note that storage of chemicals may increase the hazard profile during periods of long-term storage often associated with facility disposition activities such as S&M.

The S&H implications and regulatory considerations for each facility disposition phase are related to the hazard profile. Table 1 presents background information and regulatory considerations for each of the facility disposition phases. It should be noted that integrating and managing S&H during any phase of facility disposition follows the same basic approach. That is, the elements of hazard identification, analysis, and control are conducted regardless of the facility disposition phase. An approach for managing facility disposition hazards is presented in Chapter 3 of this *Standard.*

Table 2. Attributes, S&H Implications, and Regulatory Considerations for Facility Disposition Phases

	Deactivation	**Long-Term Surveillance and Maintenance**	**Decommissioning**
Typical Attributes	• Dynamic work environment • High activity — handling and packaging of hazardous materials/ contamination • Significant quantities of radiological and chemical hazards • Moderate activity — removal of systems, structures, and components • Stable contractor workforce	• Steady-state work environment • Minimal activity — monitoring and control of hazardous materials/ contamination • Moderate to minor quantities of radiological and chemical hazards • Minimal activity — maintenance of systems, structures, and components • Stable contractor workforce; however, can change if S&M spans an extended period of time	• Dynamic work environment • Moderate activity — handling and packaging of hazardous materials/contamination • Increased physical hazards with minor to negligible radiological and chemical hazards • High activity — removal of systems, structures, and components • Rapidly changing workforce with greater subcontractor presence
S&H Implications	• Public and environmental risks from radiological and chemical hazards • Worker risks from radiological, toxicological, and industrial hazards • Unknown or uncertain hazardous material inventories	• Worker risks from radiological, chemical, and physical hazards, but typically lower than deactivation or decommissioning because of limited activity • Unknown or uncertain hazardous material inventories as well as physical hazards • Degradation of systems, structures and components	• Presents highest risk to workers from physical hazards • Unknown or uncertain hazardous material inventories as well as physical hazards
Regulatory Considerations	• All directives contained within Appendix A of this *Standard* except those specifically for decommissioning	• All directives contained within Appendix A of this *Standard* except those specifically for decommissioning	• 29 CFR 1910.120 (HAZWOPER) applicable for facilities decommissioning under CERCLA • Applicable industrial hazard directives • Potential applicability of radiological and toxicological hazard directives • Cross-cutting directives

3.0 INTEGRATED SAFETY MANAGEMENT SYSTEM

This chapter describes an ISMS (with specific focus on its hazard management elements) that can be applied to facility disposition activities to achieve cost-effective identification, analysis, and control of all hazards. As discussed in this *Standard*, "integration" connotes incorporation of worker and facility safety activities into facility disposition work planning and execution, as well as the consolidation of S&H activities to address multiple directives that have similar intent.

To aid in cost-effective implementation of the ISMS principles, this *Standard* clarifies existing DOE S&H directives and external regulations. It also discusses S&H linkage to project management activities required by DOE 430.1 and DOE G 430.1-2, G 430.1-3, and G 430.1-4. This chapter is not intended to address or clarify all S&H issues related to facility disposition. Rather, guidance is provided on several major S&H issues related to hazard management and effective implementation of operationally oriented directives. These issues include, but are not limited to, the following:

- implementation of multiple hazard analysis requirements in a cost-effective manner while ensuring that analyses address the dynamic nature of disposition activities
- implementation of a hazard control strategy that meets both worker and facility S&H requirements, including appropriate retirement of facility safety controls during the life of the disposition activity and measures for ensuring that controls adequately address hazard uncertainties
- DOE expectations regarding hazard baseline documentation for dispositioning nuclear and non-nuclear facilities

Clarifications of implementation issues not addressed in this *Standard* will be considered in future revisions or through S&H policy interpretation by the EH Office of Nuclear Safety Policy and Standards or Office of Occupational Safety and Health Policy.

3.1 Work Planning and Hazard Identification

Effective work planning and hazard identification are two important factors influencing S&H and cost-effective implementation of facility disposition activities. During planning, overall project management systems are developed and put in place, and a disposition project's goals and objectives are translated into facility disposition tasks (see Appendix D, examples 1 through 9, related to work planning and hazard identification). Although many aspects of planning are addressed in the project management requirements provided in DOE O 430.1, *Life Cycle Asset Management*, and the guidelines contained within the

associated implementation guides DOE G 430.1-2, G 430.1-3, and G 430.1-4, this section focuses on the following S&H considerations important to planning:

- integrating S&H considerations into work planning activities
- S&H considerations associated with resource allocation
- hazard identification and characterization

3.1.1 Integrating Safety and Health Considerations into Work Planning Activities

DOE G 430.1-2, G 430.1-3, and G 430.1-4 all require the preparation of a management plan for each distinct phase of facility disposition (i.e., Deactivation Plan, Surveillance and Maintenance Plan, and Decommissioning Plan) prior to the execution of work. The purpose of these plans is to describe the work that will be performed and the methods that will be used to accomplish it. In general, these plans should include (1) reference to an agreed-upon set of S&H requirements; (2) identification of performance measures and progress metrics to be used; (3) identification of the intended ISMS approach and mechanisms; (4) description of S&H organizational responsibilities; and (5) discussion of the facility safety basis and hazard management strategy for controlling hazards.

The strategy for use and management of subcontractors during a facility disposition project should also be discussed in project plans. This includes assurance that subcontractor S&H programs are in place, adequate, and monitored. At a minimum, elements of the following subcontractor S&H programs should be evaluated, where applicable, based on hazards present: (1) respiratory protection, (2) medical monitoring, (3) hazard communication, (4) employee orientation and training, (5) confined spaces, (6) hearing conservation, (7) fall protection, (8) excavation and trenching, (9) health physics, (10) hazardous material control programs (e.g., asbestos and lead abatement), (11) spark/flame-producing operations, (12) lockout/tagout, and (13) accident investigation, injury/illness reporting, and record keeping.

Planning activities for decommissioning projects should be consistent with the DOE and Environmental Protection Agency (EPA) Memorandum of Agreement, which specifies that decommissioning be conducted as Comprehensive Environmental Response Compensation and Liability Act (CERCLA) non-time-critical removal actions. S&H activities and documentation required by the CERCLA process are similar to many DOE S&H requirements. CERCLA and DOE requirements should be integrated where possible. This includes planning, analysis, and hazard baseline documentation. Planned integration of these requirements, including rationale for how DOE and CERCLA requirements will be met, should be

provided in project plans and approved at management levels established by Cognizant Secretarial Officer (CSO) delegation of authority protocols.

Appendix C provides information on S&H performance expectations that can be used in developing project-specific performance measures. Other topics related to planning are covered in subsequent sections of Chapter 3.

3.1.2 Resource Planning

S&H is an integral part of planning and performing work. In accordance with 48 CFR 970.5204-2, *Integrating Environment, Safety and Health into Work Planning and Execution* (Department of Energy Acquisition Regulations—DEAR clauses), paragraph (b): " The contractor shall ensure that management of environment, safety and health (ES&H) functions and activities becomes an integral but visible part of the contractor's work planning and execution processes." Further, paragraph (b)(4) requires the contractor to ensure "Resources are effectively allocated to address ES&H, programmatic, and operational considerations. Protecting employees, the public, and the environment is a priority whenever activities are planned and performed." Thus, the resource implications associated with integrating S&H into all aspects of work planning, work execution, and performance monitoring should be considered. Resource planning should provide sufficient information to assure that the resources, (i.e., both funds and personnel skill mix) are adequate to develop and implement the necessary work/hazard controls. The process should also identify any projected S&H vulnerabilities and risks that cannot be addressed within the projected budget. This ensures DOE is aware of any potential site S&H vulnerabilities and provides an opportunity to identify and enforce risk management strategies, including re-scoping activities or reallocating funds and resources, to address these vulnerabilities.

Though each site's or contractor's management planning system may vary, all of these systems should be capable of assuring that adequate resources are planned for and budgeted to address the health and safety of workers and the public. Paragraph (e) of the ES&H DEAR clause (48 CFR 970.5204-2) requires the following: "On an annual basis, the contractor shall review and update, for DOE approval, its safety performance objectives, performance measures, and commitments consistent with and in response to DOE's program and budget execution guidance and direction. Resources shall be identified and allocated to meet the safety objectives and performance commitments as well as maintain the integrity of the entire System." The site's process also supports the integrated safety management framework by assuring that adequate S&H resources, including personnel skill mix issues, training requirements, and so on are planned for and budgeted to address project hazards and manage S&H vulnerabilities. DOE O 130.1,

Budget Formulation Process, and the accompanying *Annual DOE Field Budget Call* provide more specific information regarding the Department's budget planning and formulation process.

3.1.3 Hazard Identification and Characterization

One of the first steps in integrating S&H into facility disposition activities is early identification of the hazards that can affect workers and the public. Hazard identification should be conducted for all phases of facility disposition, including transitions from one phase to another. The following activities should be included:

- Assess existing facility status by collecting and reviewing available facility operating records and existing hazard baseline documentation.
- Interview past and present employees, as necessary, to supplement information on past facility operations, including mishaps and incidents.
- Assess existing facility condition and inherent hazards by performing a detailed facility walkdown using a multidisciplined team, including managers, engineers, S&H personnel, and workers.
- Identify and document the hazards associated with planned work activities.

Particular emphasis should be placed on identifying hazards that are created or increased in magnitude due to transition from one disposition phase to another (e.g., deactivation to S&M). This applies to facility transitions that were unplanned, such as a temporary cessation of operations that may turn into a long-term or permanent shutdown. In such cases, unanticipated hazards may be created that place the facility outside its authorization basis. For example, as mentioned in Section 2, chemical hazards may increase during S&M or any period of extended storage of chemicals. Chemicals left in process lines or short-term storage tanks may be subject to radiolysis, corrosion of containers, concentration due to evaporation, decomposition reactions, or other conditions.

Based on collection and evaluation of facility data, the need for intrusive characterization activities (sampling and analysis) that is necessary to understand hazards should be determined. This decision should be based on the level of uncertainty that remains regarding existing hazardous materials and facility condition. Characterization activities should be considered if knowledge of hazards is insufficient to support an understanding of hazardous material types, quantities, forms, potential exposures, and locations.

In cases where characterization activities are conducted, an adequate level of protection should be provided to workers performing these activities. For decommissioning activities subject to 29 CFR 1910.120

(HAZWOPER), this includes preparation of a Health and Safety Plan (HASP) to help ensure adequate controls for worker safety during the conduct of characterization activities. Although typically not subject to HAZWOPER, deactivation and long-term S&M activities should still meet the intent of the hazard characterization requirements. This includes documentation and communication of the following to workers: (1) potential hazards that may be encountered during characterization (including special hazardous substances, such as beryllium); (2) appropriate training and certification; (3) hazard controls and requirements, including engineering controls and personal protective equipment; (4) work procedures; and (5) an emergency response plan. Additionally, daily pre-job briefings should be conducted with workers before any characterization activity to help increase hazard awareness and to discuss specific controls for the activity.

3.1.4 S&H Requirements Identification

As directed by DOE P 450.2A, *Identifying, Implementing and Complying with Environment, Safety and Health Requirements*, and 48 CFR 970.5204-XX (DEAR clause on laws, regulations and DOE directives), information resulting from planning and hazard identification activities should be used to determine the set of S&H directives applicable to the planned facility disposition activity. The list of directives in Appendix A of this *Standard* can be used to support this assessment. The directives are organized by hazard types (radiological, physical, chemical, and biological) and a "crosscutting" category that references directives that are applicable to all missions and hazard types.

Facilities containing radiological hazards may be subject to DOE nuclear safety requirements. This determination, as described by DOE 5480.23, is dependent on the severity of radiological hazards. For decommissioning activities conducted within nuclear facilities (i.e., final Hazard Category 3 or above), whose material inventory is in the form of low-levels of residual fixed radiological contamination, nuclear safety requirements (including safety analysis reports (SAR), technical safety requirements (TSR), unreviewed safety questions (USQ), training and certification, conduct of operations, and maintenance management), can be met by following S&H requirements in 29 CFR 1910.120 and 29 CFR 1926.65, HAZWOPER. In addition, quality assurance requirements of 10 CFR 830.120, radiation protection requirements of 10 CFR 835, and occurrence reporting requirements of DOE O 232.1 should still be applied. Definitions of fixed contamination can be found in tables 2-2 and 2-4 of DOE/EH-0256T, *Radiological Control Manual*.

Decommissioning of nuclear facilities (i.e., final Hazard Category 3 or above) that contain radiological material not in a form of fixed contamination can achieve compliance with DOE 5480.23 requirements by the following: (1) complying with 29 CFR 1910.120 and 29 CFR 1926.65 requirements for S&H

programs, work plans, HASPs, and emergency response plans; (2) deriving TSRs; and (3) addressing public safety, as well as worker safety, work plans, HASPs, and emergency response plans. Whether this condition or the alternative discussed in the preceding paragraph applies, documents should be reviewed and approved in accordance with approved management levels established by CSO delegation of authority protocols.

3.2 Integrated Hazard Analysis

Several DOE directives and external regulations require hazard analysis. Table 2 identifies the hazard analysis requirements[1] that may apply to facility disposition projects (DOE 5480.23 and parts of DOE O 420.1 are applicable only to nuclear facilities). Some of these requirements are primarily oriented toward facility safety, that is, assurance that facility structure and associated safety features are adequate to protect public and workers from hazardous material inventories (chemicals and/or radiological materials). However, other hazard analysis requirements (i.e., DOE O 440.1; HAZWOPER) are primarily concerned with worker protection and emphasize an analysis of impacts from hazardous substances, as well as physical or biological hazards.

All hazard analysis requirements share the same basic intent: to identify and analyze hazards so that a sound technical basis can be established for their control. Thus, there is an opportunity to satisfy multiple requirements (both facility safety and worker protection) through an integrated hazard analysis. This concept is discussed in Section 3.2.1.

Typically, hazard analysis is performed during the planning phases of a project, when a general knowledge of work scope is known, but details of individual disposition tasks have not yet been fully determined. When using this approach, a task-specific hazard analysis should be performed during the planning of tasks using a job hazard analysis (JHA) or other suitable technique. This activity, which complements an integrated hazard analysis, is discussed in Section 3.2.2 (see Appendix D, examples 10 through 12, related to hazard analysis).

[1]Note: It is expected that most DOE facilities being dispositioned will not be affected by 29 CFR 1910.119, *Process Safety Management* (i.e., threshold quantities of listed hazardous chemicals will not be exceeded). However, the safety management principles of this regulation are considered good practice for all facilities. Although this *Standard* addresses these principles, readers may wish to review this regulation further.

Table 3. Hazard Analyses Required by Directives

Directive	Type of Hazard Analysis Required	Documentation Required
29 CFR 1910.120 29 CFR 1926.65 "Hazardous Waste Operations and Emergency Response (HAZWOPER)"	For decommissioning activities conducted under CERCLA, requires hazard analysis and control of change for all potential worker hazards. (There are other OSHA regulations that require hazard assessments [i.e., lead and asbestos] that may be applicable to disposition activities.)	HASP (Documentation of these other assessments as required by OSHA.)
DOE O 420.1 "Facility Safety"	Requires fire hazard analysis and natural phenomena analysis for all facilities. For nuclear facilities only, requires a criticality safety evaluation.	• Criticality Safety Analysis • Fire Hazard Analysis • Effects of natural phenomena hazards on facility systems structures and components (SSCs) included as part of safety analysis documented in the SAR or ***auditable safety analysis***.
DOE O 440.1 "Worker Protection Management for DOE Federal and Contractor Employees"	Requires the identification, evaluation, and control of all workplace hazards.	Specific health and safety programs and job-hazard task analysis, as needed, to implement applicable requirements.
DOE 5480.23 "Nuclear Safety Analysis Reports"	For nuclear facilities only, requires preliminary and final hazard categorization and comprehensive hazard/safety analysis to support the conclusion that nuclear facility operations can be conducted without causing unacceptable health or safety impacts to workers, public, or environment.	• SAR prepared in accordance with DOE-STD-3009 or a Basis for Interim Operation (BIO) prepared in accordance with DOE-STD-3011. • Annual updates to either SAR or BIO for those changes that do affect the analyzed safety ***basis***. • Preliminary and final hazard categorization prepared in accordance with DOE-STD-1027.
DOE O 151.1 "Emergency Management"	Identification of hazards and threats for emergency planning purposes.	Emergency Management Plan

3.2.1 Facility Baseline

An integrated hazard analysis is intended to satisfy the multiple hazard analysis requirements shown in Table 3. The intent is to evaluate all hazards based on information available from hazard identification and characterization activities as well as knowledge of the work scope for a disposition activity, thus providing a "baseline" of anticipated hazards and their potential consequences. This facility baseline should be

updated each time a facility transitions into a new facility disposition phase (e.g., operations to long-term S&M; long-term S&M to deactivation) or when a significant change occurs (as described by Section 3.4.2) to work plans or procedures. The integrated analysis supporting establishment of a facility baseline should be performed for all types of facilities and all phases of facility disposition, subject to the guidelines below.

- The analysis should evaluate radiological, physical, chemical, and biological hazards, as applicable, using a multidisciplined team of S&H personnel, engineering personnel, and facility disposition workers. Furthermore, in accordance with the concepts of DOE-STD-1104, reviewers should be involved in the early phases of analysis (Note: Although originally intended for nuclear facilities, these concepts are applicable to all facility types.)

- In cases where hazardous substances are present, analyses should evaluate (1) the type, form, quantity, and concentrations; (2) location; (3) conditions under which exposure may occur; and (4) the hazardous substance's inherent harmful characteristics (e.g., toxicity).

- The analysis should be updated throughout the duration of the facility disposition activity. This will require evaluation of the hazard facility baseline any time a change in facility disposition phase occurs (e.g., deactivation to long-term S&M) or when there is a change during a phase (e.g., building support utilities modification or termination during long-term S&M). The hazard baseline is re-evaluated to assure that (1) new hazards or energy sources have not been introduced and (2) assumptions and commitments associated with the hazard baseline are still valid. If either condition is not true, the hazard analysis should be updated, and all of the subsequent hazard controls should be examined and modified to assure that they still provide an adequate and effective level of worker and public protection.

- Facilities may rely on the existing hazard analysis (includes safety analysis performed for nuclear facilities) from the previous phase of a facility's life cycle as a "baseline" for the disposition activity when (1) the analysis was previously approved by the required level of management; (2) the analysis bounds hazards expected during the planned disposition activity; (3) no update of the analysis is needed, that is, it is applicable to the planned activities; (4) task hazard analyses are performed for disposition tasks as described in Section 3.2.2; and (5) planned disposition tasks and associated hazards are screened against the existing hazard analysis to ensure that the existing hazards analysis and their associated controls are applicable.

- The analysis should be used as the basis for emergency planning activities conducted in accordance with HAZWOPER (when applicable) and DOE O 151.1 *Comprehensive Emergency Management System*, including determination of necessary personnel, resources, and equipment for emergency response.

- The natural phenomena (e.g., seismic, tornado, etc.) hazard analysis, which is part of the integrated hazard analyses, should be performed with the following guidelines:

  (1) For facilities undergoing disposition that require confinement of releasable hazardous materials (i.e., both radiological and toxicological) for greater than 10 additional years, the requirements of DOE O 420.1, Section 4.4, *Natural Phenomena Hazards Mitigation*, should be followed.

  (2) For facilities undergoing disposition requiring less than 10 additional years of confinement functionality, the identification of a natural phenomena performance category and subsequently determined evaluation basis event is not necessary. Rather, a facility walkdown should be performed by a multidisciplined team, and the resulting walkdown information should be used in performing a simplistic/deterministic evaluation of the effects and consequences of natural phenomena events. When identifying potential effects and consequences, emphasis should be on assuring (1) life safety features, (2) hazardous material confinement, and (3) safety controls that prevent or mitigate the release of hazardous materials are adequate.

- The analysis should be documented consistent with the hazards baseline documentation guidelines provided in Section 3.3.4.

The level of effort and techniques used to perform an integrated hazard analysis will vary depending on the complexity of the disposition project work scope and the hazards present. A list of hazard analysis techniques, their appropriate use, and references is provided in Appendix E.

3.2.2 Task Hazard Analysis

An analysis of individual facility disposition tasks (i.e., discrete units of work that when combined comprise a project) should be conducted to understand impacts from worker interactions with hazards that may be introduced as a result of specific work tasks. This analysis supports the development of work packages or other methods used in planning tasks.

Task hazard analyses are conducted throughout the life of the project as disposition tasks, including routine and nonroutine S&M tasks, are planned and scheduled. The following guidelines should be used when conducting a task hazard analysis.

- The analysis should be accomplished by evaluating each step in the task's work instruction for workplace hazards and for hazards introduced from chosen work methods. This process is most effectively accomplished by performing a walkdown of the work with the workers who will perform the

task. Analysis should involve reviewing job steps associated with a task and evaluating hazardous chemicals and radiological, biological, and physical hazards.

- The analysis should involve managers, engineers, S&H personnel, and workers.
- The facility baseline, as discussed in Section 3.2.1, should be used as the basis and input for performing a task hazard analysis.
- Tasks should be screened against the facility hazards provided by the baseline hazard analysis.

The extent of task hazard analysis will vary depending on experience and familiarity in conducting the task. For example, a work task such as a previously conducted maintenance activity, which is documented in current procedures and well understood, may rely on a review of job steps and a simple hazard checklist. A task that is new and unfamiliar to workers may warrant a more detailed job hazard analysis.

3.3 Hazard Controls and Baseline Documentation

This section addresses the establishment and implementation of hazard controls for the protection of workers and the public during facility disposition activities. For any particular hazard, there may be a number of potential controls, or combination of controls, that can be applied to adequately control hazards. Elimination of hazards should always be the preferred approach. In cases where hazards cannot be completely eliminated, engineered safety features, administrative controls, or personal protective equipment should be considered in that order.

Worker safety controls are described in several DOE directives and external regulations. Specifically, DOE O 440.1, 10 CFR 835, and 29 CFR 1910.120 (HAZWOPER) specify that hazard controls be established for protection of the worker. Additionally, numerous Occupational Safety and Health Administration (OSHA) hazard-specific regulations (e.g., asbestos, lead) have been developed. A listing of these hazard-specific regulations can be found in Appendix A.

In addition to worker safety controls, DOE has specified the establishment of facility safety controls in DOE O 420.1, *Facility Safety;* DOE O 5480.23, *Nuclear Facility Safety Analysis Reports;* and DOE O 5480.22, *Technical Safety Requirements*. Together, these directives require that facility design and administrative features that are important to the facility's safety (i.e., those that ensure protection of workers and public against hazardous material release) are identified for nuclear and non-nuclear (DOE O 420.1 only) facilities and that these features are maintained and not compromised.

Although all of these directives provide valid expectations for operating facilities, the derivation, documentation, and implementation of safety controls for facility disposition activities can be complicated because of a dynamic environment where hazards and work environment are frequently changing. There is also less reliance on engineering safety controls as facility systems are removed from the facility, and a potential for uncertainty may exist in hazardous material forms and quantities (see Appendix D, examples 13 through 19, related to hazard controls and baseline documentation).

This section does not provide prescriptive guidance on how to establish controls or outline the numerous types of controls that should be in place for specific hazards; rather, the emphasis is on providing performance expectations on the following topics:

- establishment of worker safety controls
- maintaining facility safety controls in a frequently changing work environment, including phasing out controls during the life of a facility disposition project
- managing uncertainties in hazardous material inventory or facility conditions
- documentation of hazards and their associated controls to communicate to DOE the planned safety basis of the work.

3.3.1 Worker Safety Controls

Controls necessary for protection of facility disposition workers should be developed based on the strategy below, which is referenced from the *EM Occupational Safety and Health Desk Reference*, Section A-2. The following guidance is consistent with the hierarchy of controls required by DOE O 440.1 and integrates various aspects of facility safety controls.

Hazard Elimination — Avoid or minimize hazards by designing them out of chosen work methods or selecting alternate work methods. For example, substitute less hazardous or nonhazardous material or use the smallest possible quantities of necessary hazardous materials when performing chemical decontamination of systems and building structures.

Hardware Controls — Provide engineering controls to prevent unacceptable exposures to or contact with hazards or to mitigate the consequences of mishaps and accidental occurrences. Safety-significant systems, structures, and components, as defined by DOE-STD-3009, should be maintained for worker protection until the hazardous condition that necessitated the safety-significant control is removed (see Section 3.3.2). Examples of other engineering features that should be implemented as needed include

shoring for excavation, local exhaust ventilation systems, redundant control devices (e.g., valves), and barriers.

Administrative Controls — Use administrative controls that include limits on activities, S&H procedures, and work instructions to complement the above activities. These controls should also include inventory limits to prevent unauthorized consolidation of hazardous materials in a given facility area or introduction of new hazardous materials into the facility.

Personal Protective Equipment — Personnel Protective Equipment (PPE) may be necessary, but it should not be used, without justification, in lieu of the more reliable control strategies mentioned above. PPE should be based on the perceived hazard, used in accordance with established procedures and training, and periodically evaluated for effectiveness.

Occupational Medical Program — Establish and maintain an occupational medical program, including access to a board certified occupational physician. Workers should be physically qualified based on expected hazards and stresses associated with planned facility disposition tasks. Medical surveillance, including biological exposure monitoring, may be a necessary component of the occupational medical program to ensure control of certain hazards, such as chemical, radiological, ergonomic, and biological hazards.

Monitoring — Monitor air in the workplace during facility disposition activities to verify adequate control of airborne hazards. Exposure limits provided in the source documents referenced in DOE O 440.1, paragraph 4(L), should be maintained. Personal exposure monitoring equipment, including equipment for monitoring physical agents such as noise, should be used as part of an overall Industrial Hygiene Program.

Training — Define the requirements pertaining to worker qualification associated with the planned work task. Training and qualification should ensure that workers are qualified to recognize any potential hazards that may be encountered. Specific worker training should be determined based on work task knowledge and the hazards identified by the hazard analysis. Training requirements are provided in numerous OSHA regulations. These regulations are specific to hazard types (asbestos, lead, radiation) as well as to activities (construction, demolition) and job classifications (i.e., HAZWOPER prescribes different levels of training depending on employee responsibility). Training programs for nuclear facilities must comply with DOE 5480.18 and DOE 5480.20A**.**

Work Packages — Cognizant facility safety representatives should verify and approve work instructions, worker qualification, and specification of task hazard controls (e.g., special permits such as

radiation work permits) using work packages or other types of work control system. This concept is similar to work control systems as addressed in the attachment to DOE 4330.4B, *Maintenance Management Program*. To be effective, work packages should be prepared with input from workers involved in the disposition task and should include (1) a description of the task to be performed, (2) verification that an analysis of task hazards has been performed, (3) necessary work permits specifying hazard controls, (4) training requirements for the job, (5) equipment and materials to be used in performing the task, (6) needed PPE, (7) emergency response actions, and (8) expected results at completion of task.

Finally, anticipated hazards and their controls should be clearly communicated to workers in health and safety plans (where required by HAZWOPER) or other equivalent means (see Section 3.3.4), and in pre-job briefings before work begins.

3.3.2 Facility Safety Controls

Due to changing hazardous material inventories, uncertainties, and discoveries, facility disposition activities present situations in which facility safety controls can be expected to change throughout the lifetime of the project. These changes can range from modifying or eliminating existing controls to implementing new, more restrictive, or modified safety controls.

It is appropriate to expect that less reliance on facility design and administrative features will be necessary as the project progresses and hazardous materials are removed. For example, the operational limits imposed on a processing vessel to prevent a release of hazardous material are no longer valid if the material has been removed. The following criteria should be used when determining if it is appropriate to retire a control.

(1) Hazardous condition being controlled is no longer present.

(2) Hazardous materials are no longer present.

(3) Hazardous material's physical form has changed to a less dispersible form.

(4) Hazardous material quantities have been reduced to the point where the consequences of releases are no longer a concern.

New safety controls may need to be developed for some facilities entering a disposition phase to fully comply with DOE O 420.1 requirements regarding natural phenomena and fire hazards. These controls could address facility or structural enhancements, source containment integrity, or removal of hazardous

materials. Control for these types of hazards should focus on identifying these vulnerabilities and should be implemented in the following order of priority (or combination thereof): (1) modifying operations and enhancing emergency planning and other contingencies, rather than dedicating resources for enhancing facility structures; or (2) enhancing confinement integrity. For example, dispersible materials should be removed and contained, to the extent practical, and the containers physically secured to structures that provide enhanced stability or resistance to natural phenomena or fires. Finally, it may be useful to re-evaluate the planned work scope and consider accelerated removal of releasable hazardous material when the above controls cannot be practically achieved. DOE G-420/G-440.1, *Implementation Guide for DOE O 420.1 and DOE O 440.1, Fire Safety Program*, provide additional guidance on fire protection for surplus facilities.

3.3.3 Uncertainties in Material Inventory Estimates or Facility Conditions

Uncertainties may exist in material inventories or hazardous conditions that need to be reflected in safety controls. For example, such a situation can be encountered if invasive characterization is needed to confirm material inventories (e.g., obtaining samples of materials in locations or vessels that are not readily accessible). When this condition exists, conservative assumptions should be made within safety controls to avoid delaying approval of project task initiation, provided that (1) hold points are established for conducting characterization or additional analysis to determine if the condition warrants establishing or changing a safety control, and (2) assumptions are sufficiently conservative to ensure that safety is not compromised before or during characterization activities. For example, if trace quantities of mercury are expected to be in an abandoned laboratory, it is prudent to assume a larger quantity until the actual quantity can be verified.

3.3.4 Hazard Baseline Documentation

The purpose of hazard baseline documentation is to provide a formal record of the identified hazards and the controls that are established to support safe work execution. The type of documentation that should be prepared is primarily dependent on facility classification, with some special considerations for certain facility disposition phases as discussed below. Facilities should be designated as either nuclear or non-nuclear. For documentation purposes, this standard consolidates the designations of radiological, non-nuclear, and industrial, as defined in accordance with DOE-EM-STD-5502-94, into the non-nuclear facility type. Sites that have previously implemented DOE-EM-STD-5502-94 facility designations may continue to use them for the intended purposes.

Table 4 specifies the hazard baseline documents expected for each facility type. The types of hazard baseline documents that support safe facility disposition activities typically are a HASP for the specific case of decommissioning, a documented hazard analysis, a BIO, or a SAR. The following is a brief discussion of each of these documents.

HASP— A HASP is required by 29 CFR 1910.120 and 29 CFR 1926.65 and applicable to decommissioning activities. The emphasis of the HASP is primarily on worker safety. The HASP should be updated continually throughout the disposition activity to reflect newly identified job hazards and worksite conditions, as needed, to verify that work can be conducted safely.

Documented Hazard Analysis — Documented hazard analyses are prepared for non-nuclear facilities. The intent of the documented hazard analysis is to provide formal documentation of the integrated hazard analysis and associated controls. An auditable safety analysis, which was originally required by DOE 5481.1B, is a form of a documented hazard analysis. The documented hazard analysis should contain a facility description and summaries of activities and procedures, hazard analyses, safety programs and controls, and administrative controls.

SAR/BIO— SARs are required for nuclear facilities in accordance with DOE 5480.23. When an existing DOE facility SAR does not meet the requirements of this order, a BIO is generally prepared as an interim authorization basis document until the SAR can be upgraded. DOE-STD-3011, *Guidance for Preparation of DOE 5480.22 (TSR)* and *DOE 5480.23 (SAR) Implementation Plans*, provides guidance for preparing a BIO.

BIOs may serve as the authorization basis for many facility disposition activities, since often these activities are of short duration and the time and expense of upgrading a SAR is not justified. When this is the case, a BIO may be used as a hazard baseline document for the duration of the facility disposition

activity, as long as it is maintained and updated in accordance with the requirements of DOE 5480.23, para 9 (c). However, the basis for using a BIO and justification for not upgrading the SAR should be provided in an implementation plan and approved at the level of management consistent with defined CSO delegation of authority protocols. A BIO should not be used in lieu of a SAR upgrade when the disposition phase is surveillance and maintenance of a facility that has not been deactivated to the extent that radiological inventory (excluding fixed contamination, as defined in Section 3.1.4) has been removed below DOE-1027-92, Hazard Category 3 thresholds.[1]

BIOs should document the methodology used to identify and analyze hazards and associated controls, including specification and implementation of safety class and safety significant controls and the facility specific application of site generic health and safety programs. The BIO needs to identify facility vulnerabilities and provide commitments for their resolution or operational restrictions necessary to prevent identified vulnerabilities from causing undue consequences.

For decommissioning of nuclear facilities, or nuclear facilities undergoing S&M, whose material inventory is in the form of low-level fixed radiological contamination, the intended function of a SAR or BIO may be accomplished by complying with the requirements of 29 CFR 1910.120 or 29 CFR 1926.65, subject to the conditions discussed in Section 3.1.4. For decommissioning or S&M of nuclear facilities with releasable radiological materials, the information that is normally contained within the nuclear safety hazard baseline document (i.e., SAR or BIO) may be included as an addendum to the HASP. Specifically, information supporting the derivation of TSRs, as wellas a detailed accident analysis or hazard analysis, which is needed to properly identify controls to help ensure worker and public protection, should be presented. The extent of this information should be necessary only to demonstrate that releasable materials have been adequately confined or the consequences adequately mitigated. The DOE 5480.21 unreviewed safety question process should be used to ensure that the document is maintained in an up-to-date form. Furthermore, additional quality assurance considerations per 10 CFR 830.120, *Quality Assurance,* above and beyond those of a typical HASP may be necessary (e.g., enhanced record keeping).

[1]As directed by the June 9, 1997, interpretation letter from Richard L. Black, Director, Office of Nuclear Safety Policy and Standards.

3.3.5 Assessing the Adequacy of Existing Hazard Baseline Documentation

In many cases hazard baseline document may already exist from the operations phase of the facility or from previous facility disposition phases. This document may be a meaningful starting point when developing a new hazard baseline document. For example, information in a SAR can be used as the starting point for a non-nuclear facility's documented hazard analysis. Furthermore, approved existing hazard baseline documents may be used for facility disposition if the criteria in Section 3.2.1, for use of existing hazards analysis, are met and the following information is provided:

- a description of the site and location, including current facility and site boundaries
- design criteria for those safety structures, systems, and components (for nuclear facilities, safety class and safety-significant equipment as defined by DOE-STD-3009) needed to support safe facility disposition work
- normal and emergency operating procedures that are based on a hazard analysis that is still representative of planned future work
- operational limitations due to existing facility vulnerabilities

Table 4. Hazard Baseline Documentation

Types of Work	Hazard Baseline Document			
	SAR[a]	BIO[b]	HASP[c]	Other[d]
Deactivation of nuclear facility (Note: Use existing SAR if adequately deactivation hazards.)		X		
Deactivation of non-nuclear facility				X
Long-term surveillance and maintenance of surplus nuclear facility (inventory is residual fixed contamination)			X[e]	
Long-term surveillance and maintenance of surplus nuclear facility (inventory is not residual fixed contamination)	X[f]	X		
Long-term surveillance and maintenance of non-nuclear facility				X
Decommissioning of nuclear facility (inventory is residual fixed contamination)			X[e]	
Decommissioning of nuclear facility (inventory is not residual fixed contamination)			X[g]	
Decommissioning of non-nuclear facility			X	

[a]Safety Analysis Report (SAR) as defined by DOE 5480.23 and DOE-STD-3009.

[b]Basis for Interim Operation (BIO) as defined by DOE 5480.23 and DOE-STD-3011. Provides interim authorization basis during SAR upgrades.

[c]Health and Safety Plan (HASP) in accordance with 29 CFR 1910.120 or 29 CFR 1926.65.

[d]May range from auditable safety analysis as described in the DOE 5481.1B document to demonstrated compliance with OSHA (depending on hazard severity/job complexity).

[e]Applicable requirements of 10 CFR 830.120 (*Quality Assurance*) and DOE O 232.1 (*Occurrence Reporting*) should be met as well as the establishment of an inventory control administrative TSR.

[f]The SAR should be upgraded for extended periods of S&M.

[g]Augmented HASP that also includes evaluation of public safety and establishment of TSRs.

3.4 Work Performance

This section discusses two important S&H considerations related to work performance. First is a discussion of project "readiness" before initiating work and the range of activities that are appropriate for facility disposition activities. The second topic discussed is change control or worker safety considerations that are necessary to maintain a disposition project's safety basis once work has begun (see Appendix D, examples 20 through 23, related to work performance).

3.4.1 Readiness Review Process

A readiness review should be completed before beginning work to ensure that all hazards have been identified, appropriate S&H requirements have been met, and safety systems and controls (e.g., procedures and training) are in place and capable of performing their intended function. The scope and rigor of activities necessary to determine readiness for facility disposition activities will vary depending on the type and magnitude of hazards present and the complexity of the work to be performed.

Requirements and guidance for performing readiness reviews for a nuclear facility are provided in DOE O 425.1, *Startup and Restart of Nuclear Facilities*, and are supplemented by DOE-STD-3006-95, *Planning and Conduct of Operational Readiness Reviews*. These requirements are applicable to nuclear facilities (i.e., final Hazard Category 3 or above) undergoing facility disposition and should be implemented when there is a (1) transition from operations to facility disposition; (2) transition from one disposition phase to another (e.g., deactivation to decommissioning); or (3) transition of contractor responsible for managing the facility. As reflected in DOE-STD-3006-95 guidance, an Operational Readiness Review (ORR) should be performed for Hazard Category 2 nuclear facilities, while a Readiness Assessment (RA) is appropriate for a Hazard Category 3 facility. For facility disposition activities, the decision to perform an ORR should be discussed on a case-by-case basis with the CSO. Further, the scope of the ORR or RA efforts should focus on the changes to operations, hazards, equipment, or personnel that have occurred since the last detailed assessment that was performed on that facility (e.g., prior operations-oriented ORR or RA, self-assessments, or external assessments).

Although not subject to DOE O 425.1 requirements, some form of a readiness review should always be conducted on non-nuclear facilities before beginning work. The readiness review should provide evidence that the following elements have been accomplished: (1) all hazards have been adequately characterized; (2) a hazard analysis has been performed and controls are established for protection of workers; (3) adequate safety procedures, emergency response procedures, and work instructions have been developed and are in place; (4) personnel are knowledgeable of the work scope to be performed and of the associated hazards; (5) personnel have the training and qualifications necessary for the work to be performed; and (6) safety systems are operable

and maintained according to design specifications. Simple checklists, as presented in Appendix F, may be used to conduct the readiness review. In all cases, readiness reviews should be conducted by an organization that is not directly involved with the day-to-day management of the facility disposition activity.

3.4.2 Management of Change

The purpose of facility disposition activities is to remove hazards and, subsequently, the facility equipment, systems, and structures no longer needed for control and confinement of hazardous materials. During the performance of this work, hazardous materials or conditions may be discovered that have not been previously analyzed. Further, work may become necessary that has not been planned for or included in existing safety documents. In order to ensure that safety controls are current, adequate, and documented, it is important that a management of change (MOC) process be developed. An MOC should evaluate all proposed activities, changes, and discoveries (referred to collectively as "change" for the remainder of this section) that may affect facility or worker safety.

The MOC process should be developed for both nuclear and non-nuclear facilities. The MOC should define a mechanism for evaluating the significance of any change, the need for additional analysis and safety controls, the documentation affected or required by the change, and the approval and training requirements for implementing the change. MOC screening and evaluation methodology should be developed for the following levels of change:

- minor changes that may impact job controls or instructions specified in work plans and that should be implemented with minimum review (e.g., typos, administrative details, insignificant changes that have no potential to impact health and safety)

- changes that may impact the original work plans and may require worker and/or facility safety evaluation, but do not require changes to existing safety documentation and/or work permits (e.g., hazardous material in quantities or locations different than assumed)

- changes that may impact the safety basis and require changes and approvals to the original facility safety documentation and/or work permits (e.g., unanalyzed hazards that require new analysis and/or safety controls)

For nuclear facilities, the evaluation of changing conditions of the facility, or proposed disposition activities should be performed using the Unreviewed Safety Question (USQ) process of DOE 5480.21, *Unreviewed Safety Questions*. A determination should be made that proposed work, or changing facility conditions (as disposition activities proceed) will be within defined boundaries of the authorization basis for the facility. The USQ requirements, as described in DOE 5480.21, utilize a screening process which should be used to evaluate

the safety of workers and the public, along with protection of the environment. Using the USQ process during a deactivation project allows the DOE contractor to proceed expeditiously without prior DOE approval as long as the changes do not explicitly, or implicitly affect the safety authorization basis. If a USQ is determined to exist, it does not necessarily mean that the activity is unsafe. Rather, identifying a USQ serves to alert DOE and facility management to potential conditions that could effect the facility authorization basis.

As required by DOE 5480.21, worker safety considerations are to be included in the MOC and performed for specific disposition work tasks. Screening and evaluation criteria should be developed and implemented that can provide answers to the following questions:

- Is there an unanalyzed hazard, change, or increase in uncertainty in analyzed hazards or a change in hazardous material type, form, or quantity as a result of the proposed activity or discovery that could affect (directly or indirectly) the health and safety of workers at or around the job site?

- Are prescribed safety controls and protective equipment adequate to protect the worker, as defined by an approved analysis of worker hazards, and have the safety controls been reviewed and approved by both worker safety professionals and the worker?

Non-nuclear facilities should follow the same concepts as provided in DOE 5480.21 and the worker safety considerations described above. In addition, facility MOCs should address hazardous material inventory maintenance to ensure the rigor of hazards analysis and safety controls are commensurate with the inventory changes.

3.5 Feedback and Evaluation

Because of the dynamic nature of facility disposition activities, work monitoring and periodic self-assessments are a particularly important aspect of a properly functioning facility disposition safety management system. As stated in section 3.1, it is useful to develop project-specific performance indicators and measures to monitor S&H performance while conducting work tasks. Through self-assessments (as required by DOE O 210.1, *Performance Indicators and Analysis of Operations*, Attachment 1, and DOE O 440.1, *Worker Protection for DOE Federal and Contractor Employees*, Attachment 2) data regarding project, activity, and task performance can be gathered. Insights gleaned from this information should be integrated into project planning and work execution as quickly as practical, so that good practices and lessons learned from previous work can be used for the next project task (see Appendix D, example 24, related to feedback and evaluation).

Lessons learned from performance measures should also be shared across the DOE complex. DOE O 225.1, *Accident Investigations*; DOE O 231.1, *Environment, Safety and Health Reporting;* and DOE O 232.1, *Occurrence Reporting and Processing of Operations Information*, require that information related to accidents,

mishaps, and near-misses be reported and disseminated throughout the DOE complex to help prevent similar situations from being repeated.

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NOT MEASUREMENT SENSITIVE

DOE-STD-1120-98
XXXX, 1998
(Volume 2 of 2)

DOE STANDARD

INTEGRATION OF SAFETY AND HEALTH INTO FACILITY DISPOSITION ACTIVITIES

Volume Two: Appendices

Draft for DOE Complex Wide Review- 9/26/97

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

AREA GDRQ

TABLE OF CONTENTS

Volume 2

INTRODUCTION

This volume contains the appendices that provide additional safety and health (S&H) information in support of Volume 1 of this *Standard*. Appendix A provides a compilation of existing S&H directives and external regulations, organized by hazard types, that can be used as the starting point for developing a set of specific facility/activity S&H requirements. Appendix B provides an overview of the Work Smart Standards Process. Appendix C provides S&H performance expectations to guide a project team in developing and implementing an effective integrated safety management program. Appendix D provides examples and lessons learned that illustrate implementation of S&H approaches discussed in Chapter 3 of Volume 1. Appendix E provides information on available hazard analysis techniques and references. Appendix F provides a sample readiness review checklist.

Appendix A

Safety and Health Directives

Applicable to Facility Disposition Activities

SAFETY AND HEALTH DIRECTIVES APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

The intent of this Appendix is to provide a roadmap to potentially applicable Department of Energy (DOE), Occupational Health and Safety Administration (OSHA), and Environmental Protection Agency (EPA)[1] safety and health requirements for disposition activities. This roadmap will assist DOE project managers, contractors, and subcontractors in identifying the applicable safety and health requirements that must be considered to ensure the protection of the public and workers during facility disposition activities.

Table A-1 provides a listing of mandatory[2] and non-mandatory S&H directives with a brief summary given for each directive. This listing is not intended to convey the set of directives that should be applied to all disposition activities and situations. The specific directives that are applicable to a facility or work activity are dependent upon the facility's and activity's work scope and associated hazards. For example, the set of directives that are applicable to deactivating a plutonium processing facility is entirely different from the set for decommissioning a guard house containing asbestos.

As shown in Figure A-1, the listing is organized by the type of hazard addressed by the directive: hazardous materials, radiological materials, physical, and biological. This organization is intended to facilitate the identification of hazard-specific requirements. Directives that are not strictly driven by the type of hazard, such as DOE O 151.1, *Comprehensive Emergency Management System*, and DOE O 225.1, *Accident Investigation*, are identified as crosscutting directives. These are applicable regardless of the hazards and work scope.

This listing is a reference tool to facilitate the identification of applicable directives for a facility disposition activity. For example, if the work involves interaction with lead and radiological materials, the table provides reference(s) to the specific directive(s) that need to be considered for each of these hazards. The strategy for managing and controlling facility disposition activity hazards, including the identification of applicable directives using a team approach with direct worker involvement, is discussed in Section 3 of Volume 1.

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1 A discussion of the potentially applicable EPA directives is beyond the scope of this standard. The EM *Decommissioning Resource Guide* provides discussions of these directives.

2 Table A-1 directives with an asterisk (*) are mandatory when the disposition activity's work scope and hazards are covered by the directive. Also, DOE orders are mandatory when listed in a contract that has been negotiated with DOE to address the disposition activity.

Figure A.1 - Organization of Directives Road map

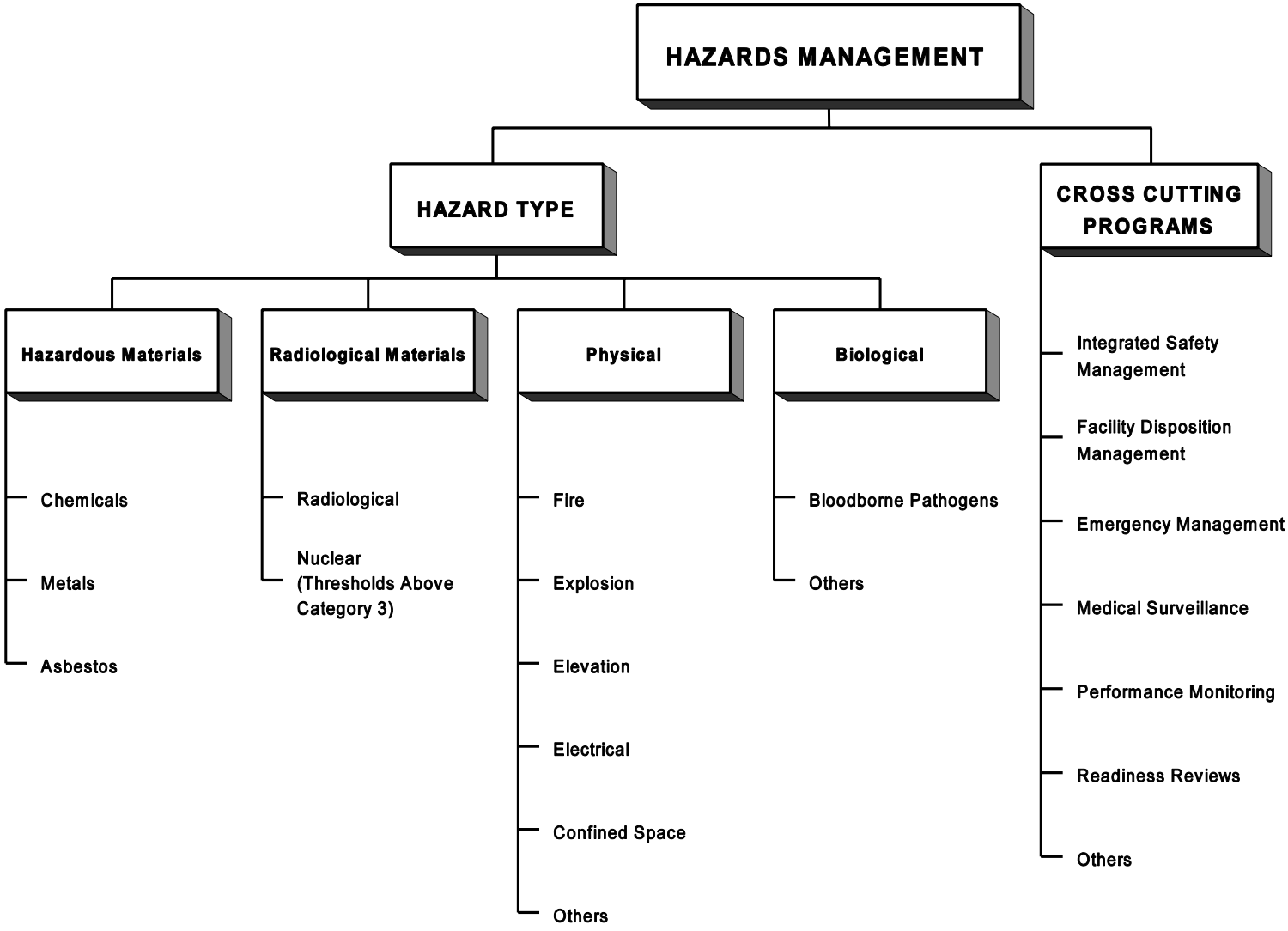

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
SAFETY MANAGEMENT	
*DOE P 450.4 Safety Management System Policy	Establishes the components necessary for a Safety Management System to provide a formal, organized process whereby people plan, perform, and improve the safe conduct of work. The system encompasses all levels of activities and documentation related to safety management throughout the DOE complex.
CROSSCUTTING PROGRAMS	
*DOE P 450.2A Identification, Implementation and Compliance with ES&H Requirements	Sets forth the framework for identifying, implementing and complying with ES&H requirements so that work is performed in the DOE complex in a manner that ensures adequate protection of workers, the public, and the environment. This framework is an integral part of the Department's commitment to a standards-based management system.
*DOE 4330.4B Maintenance Management Program	Provides general policy and objectives for the establishment of programs for the management and performance of cost-effective maintenance and repair of DOE property. Contains guidelines for establishing and conducting a maintenance program in both nuclear and non-nuclear facilities.
*DOE O 440.1 Worker Protection Management for DOE Federal and Contractor Employees	Establishes the framework for an effective worker protection program that will reduce or prevent accidental losses, injuries, and illnesses by providing DOE Federal and contractor workers with a safe and healthful workplace.
*DOE O 420.1 Facility Safety	Establishes facility safety requirements related to fire protection and natural phenomena hazards mitigation.
DOE N 450.3 Use of Necessary and Sufficient Process	Provides requirements and guidance for near-term use of the Necessary and Sufficient Process.
DOE M 450.3-1 Necessary and Sufficient Closure Process	Describes the six elements established for the "Closure Process for Necessary and Sufficient Sets of Standards," and summarizes "lessons learned" from the pilots. The process can be applied at any organizational level and by any organization within the DOE complex, and can be used to establish contractual commitments between the Department and its contractors.
*DOE O 151.1 Comprehensive Emergency Management System	Provides requirements for the establishment of an Operational Emergency Base Program that provides the framework for response to serious events involving health and safety, the environment, safeguards, and security. Also requires an operational emergency hazardous material program to supplement the Base Program.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
DOE-HDBK-5504-95 Guidance for Evaluation of Operational Emergency Plans	Provides guidance for evaluating emergency plans.
*29 CFR 1910.120(l) or (q) Hazardous Waste Operations and Emergency Response	Paragraph (l) contains requirements to ensure worker health and safety during emergency response for hazardous waste operations; includes projects conducted under CERCLA. Paragraph (q) contains requirements to ensure worker health and safety during emergency releases of hazardous materials wherever they occur. This section may apply to any facility disposition activity where onsite emergency responders are used. Potentially addressed by DOE O 151.1.
*DOE 3790.1B-Ch.VIII Federal Employee Occupational Medical Program	Applies to Federal employees not covered under the occupational medical program requirements for contractors in DOE O 440.1. This standard requires Heads of DOE Field Elements with Delegated Personnel Authority to develop, establish, provide, and maintain a Federal Employee Occupational Medical Program.
*29 CFR 1910.120(f) or (q)(9) Medical Surveillance for Hazardous Waste Operations and Emergency Response	Paragraph (f) contains specific medical surveillance program requirements for employees conducting hazardous waste operations and whose potential exposure levels exceed specified limits. Paragraph (q)(9) requires a medical surveillance program for members of organized and designated HAZMAT teams and for hazardous materials specialists, as defined in this standard. This may apply to designated HAZMAT team members for any facility disposition activity. See OSHA's 29 CFR 1910 Subpart Z and 129 CFR 1926.62 for substance-specific medical surveillance requirements.
*10 CFR 830.120 Quality Assurance Requirements	Provides requirements for the development of a quality assurance program.
*DOE 5482.1B ESH Appraisal Program	Establishes the Environment, Safety & Health (ES&H) Appraisal Program for the Department of Energy. It requires the following appraisals: management, technical safety, functional, internal, environmental survey.
*DOE O 210.1 Performance Indicators and Analysis of Operations Information	Provides requirements to identify, monitor and analyze data that measures the ES&H performance of facilities, programs, and organizations.
DOE-STD-1010-92 Incorporating Operating Experiences	Contains methods for incorporating operating experiences into facility programs. These experiences from facilities or industry should be incorporated in a manner that is systematic and timely in conveying useful information.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
DOE-STD-7501-95 Development of DOE Lessons Learned Programs	Defines the framework for development of a lessons learned program. When specifically referenced and required to be implemented, this technical standard applies to all DOE Headquarters and field organizations, management and operating contractors, and laboratories establishing a lessons learned program. For organizations with existing lessons learned programs, this technical standard will facilitate self-assessment to determine whether existing structures contain the essential elements for consistency and compatibility.
DOE-STD-3006-95 Planning and Conduct of Operational Readiness Reviews	Provides guidance on the planning and conduct of Operational Readiness Reviews (ORRs). This standard also provides guidance for requesting exemptions. The requirements for ORRs and readiness assessments (RAs) apply both to responsible contractors and to DOE. This standard addresses the requirements and suggests methods and approaches for ORRs and RAs.
*DOE O 225.1 Accident Investigations	Prescribes requirements for conducting investigations of certain accidents occurring at DOE operations and sites to improve the environment, safety, and health for DOE, contractors, and the public and to prevent the recurrence of such accidents.
DOE G 225.1-1 Guide for DOE O 225.1 Accident Investigations	Explains the requirements addressed in DOE O 225.1 and provides guidance regarding acceptable methods for implementing those requirements. The approach to investigations described in the Guide is similar to, and consistent with, methods used by other government agencies and private industry.
*DOE O 231.1 Environment, Safety and Health Reporting	Ensures the collection and reporting of information on environment, safety, and health that is required by law or regulation to be collected, or that is essential for evaluating DOE operations and identifying opportunities for improvement needed for planning purposes within the DOE. Requires compliance with OSHA record keeping requirements in 29 CFR 1904, 29 CFR 1926.33, and the recently finalized 29 CFR 1910.1020.
DOE M 231.1-1 Environment, Safety and Health Reporting Manual	Provides detailed requirements to supplement DOE O 231.1, *Environment, Safety and Health Reporting,* which establishes management objectives and requirements for reporting environment, safety ,and health information.
*DOE O 232.1 Occurrence Reporting and Processing of Operations Information	Ensures that DOE and DOE contractor management are informed on a timely basis of events that could adversely affect national security or the safeguards and security interests of DOE; the health and safety of the public, workers; and the environment; the intended purpose of DOE facilities; or the credibility of the Department.
DOE M 232.1-1 Occurrence Reporting and Processing of Operations Information	Provides detailed information for categorizing and reporting occurrences at DOE facilities. It complements DOE O 232.1 and its use is required by that Order.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
*29 CFR 1910 Subpart I Personal Protective Equipment	*General Industry* Provides requirements for the selection, use, and maintenance of eye and face protection, respiratory protection, head protection, foot protection, and electrical protective equipment.
*29 CFR 1926 Subpart E Personal Protective and Life Saving Equipment	*Construction* Provides requirements for construction operations for the selection, use, and maintenance of foot protection, protective clothing; respiratory protection for fire brigades; head protection, hearing protection, eye and face protection, and respiratory protection; and detailed requirements for working over or near water.
HAZARDOUS MATERIALS	
Chemicals	
*29 CFR 1910.120 Hazardous Waste Operations and Emergency Response (HAZWOPER)	*General Industry* Requires a safety and health program and site-specific safety and health plan for cleanup operations involving hazardous substances; operations involving hazardous wastes that are conducted at TSD facilities; and emergency response operations for releases of, or substantial threats of release of, hazardous substances.
*29 CFR 1926.65 Hazardous Waste Operations and Emergency Response	*Construction* Requires a safety and health program and site-specific safety and health plan for cleanup operations involving hazardous substances; operations involving hazardous wastes that are conducted at treatment, storage, and disposal (TSD) facilities; and emergency response operations for releases of, or substantial threats of release of, hazardous substances.
DOE/EH-0535 Handbook for Occupational Health and Safety During Hazardous Waste Activities	Provides guidance for establishing and implementing comprehensive, cost-effective, hazard-based worker health and safety programs that meet the requirements of DOE and DOE-adopted OSHA health and safety directives for hazardous waste activities.
*29 CFR 1910.1000 OSHA "Z Tables" within Subpart Z	*General Industry* Provides permissible exposure limits (PELs) for most air contaminants regulated by OSHA and stipulates a hierarchy of controls to achieve compliance. See description of 29 CFR 1910.1001-1050 .

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
*29 CFR 1926.55 Gases, Vapors, Fumes, Dusts, and Mists (comparable to "Z Tables")	*Construction* Provides PELs for most air contaminants regulated by OSHA and stipulates a hierarchy of controls to achieve compliance. See description of 29 CFR 1926 Subpart Z and 29 CFR 1926.62.
*29 CFR 1910.1001-1050 Substance-Specific Standards within Subpart Z	*General Industry* Provide worker safety and health requirements for exposures to specific chemicals, primarily carcinogens. Includes requirements such as exposure monitoring, worker training, exposure controls, regulated areas, and medical surveillance of workers who are potentially exposed to specific hazardous substances. Includes standards for substances often involved in facility disposition activities such as asbestos, lead, and cadmium.
*29 CFR 1926 Subpart Z Substance-Specific Standards	*Construction* Contains worker safety and health requirements for exposures to specific chemicals, primarily carcinogens. Includes requirements such as exposure monitoring, worker training, exposure controls, regulated areas, and medical surveillance of workers who are potentially exposed to the specific hazardous substances. Includes standards for substances often involved in facility disposition activities such as asbestos, lead, and cadmium.
DOE-HDBK-1100-96 Chemical Process Hazard Analysis	Provides guidance for performing the process hazards analysis required by 29 CFR 1910.119.
DOE-HDBK-1101-96 Process Safety Management for Highly Hazardous Chemicals	Provides guidance for implementing 29 CFR 1910.119 for DOE facilities.
*29 CFR 1910.1200 Hazard Communication	*General Industry* As it applies to facility disposition, requires that information concerning hazards and appropriate protective measures for chemical substances in the workplace are transmitted to personnel through appropriate labeling, Material Safety Data Sheets (MSDS), signs, and training. A written hazard communication program is required. (Note: This section does not apply to substances that are the focus of remediation under CERCLA or to RCRA hazardous waste.)

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
*29 CFR 1926.59 Hazard Communication	*Construction* As it applies to facility disposition, requires that information concerning hazards and appropriate protective measures for chemical substances in the workplace are transmitted to personnel through appropriate labeling, MSDSs, signs, and training. A written hazard communication program is required. (Note: This section does not apply to substances that are the focus of remediation under CERCLA or to RCRA hazardous waste.)
*29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories	*General industry* Potentially applicable during deactivation and surveillance & maintenance. If laboratory use of hazardous chemicals is occurring during facility disposition activities, this standard may apply. **Where it applies, it generally supersedes OSHA's Subpart Z health standards. Refer to this standard for specific qualifications on scope and applicability.**
Metals	
*29 CFR 1910.1025 Lead	*General Industry* Contains requirements for employee exposure to lead, including PELs, exposure monitoring, hazard controls and protective equipment, medical surveillance, worker training, and recordkeeping. Does not cover construction workplaces.
*29 CFR 1926.62 Lead	*Construction* Contains requirements for employee exposure to lead in construction workplaces, including PELs, exposure monitoring, hazard controls and protective equipment, medical surveillance, worker training, and recordkeeping.
*29 CFR 1910.1027 Cadmium	*General Industry* Contains requirements for employee exposure to cadmium, including PELs, exposure monitoring, regulated area establishment, hazard controls and protective equipment, written emergency plan, medical surveillance, worker training, and recordkeeping. Does not apply to construction workplaces.
*29 CFR 1926.1127 Cadmium	*Construction* Sets requirements for employee exposure to cadmium in construction workplaces, including PELs, exposure monitoring, regulated area establishment, hazard controls and protective equipment, written emergency plan, medical surveillance, worker training, and recordkeeping.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
Asbestos	
*29 CFR 1910.1001 Asbestos	*General Industry* Applies to all occupational exposures to asbestos in all industries covered by OSHA, except for construction work, and includes requirements for PELs, exposure monitoring, methods of compliance, regulated areas, respiratory protection, protective work clothing and equipment, hygiene facilities and practices, communication of hazards to employees, housekeeping, medical surveillance, record keeping, and observation of monitoring practices.
*29 CFR 1926.1101 Asbestos	*Construction* Applies to all construction work and includes requirements for PELs, exposure monitoring, regulated areas, methods of compliance, respiratory protection, protective clothing and equipment, hygiene facilities and practices, communication of hazards to employees, housekeeping, medical surveillance, and record keeping.
RADIOLOGICAL MATERIALS	
Radiological	
*DOE P 441.1 DOE Radiological Health and Safety Policy	Sets forth DOE's approach to radiological health and safety.
*10 CFR 835 Occupational Radiation Protection	Provides the regulations for occupational radiation protection of workers at DOE facilities. The provisions of 10 CFR 835 provide nuclear safety requirements, which if violated, will provide the basis for the assessment of civil and criminal penalties under the Price-Anderson Amendments Act of 1988.
*DOE/EH-0256T DOE Radiological Control Manual	Provides guidance for the establishment of radiological control activities at DOE facilities.
G-10 CFR 835/B1 Radiation Protection Program	Provides an acceptable methodology for documenting the development of an occupational radiation protection program that will comply with DOE requirements.
G-10 CFR 835/B2 Occupational ALARA Program	Provides an acceptable methodology for establishing and operating an occupational ALARA (as low as reasonably achievable) program that will comply with DOE requirements.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
G-10 CFR 835/C1 Internal Dosimetry Program	Provides an acceptable methodology for establishing and operating an internal dosimetry program that will comply with DOE requirements.
G-10 CFR 835/C2 External Dosimetry Program	Provides an acceptable methodology for establishing and operating an external dosimetry program that will comply with DOE requirements.
G-10 CFR 835/C3 Radiation Generating Devices	Provides an acceptable methodology for establishing and operating a radiation generating device (RGD) control program that will comply with DOE requirements. This also applies to radiography sources. Section IV.B.8 covers RGD decommissioning.
G-10 CFR 835/C4 Evaluation and Control of Fetal Exposure	Provides an acceptable methodology for establishing and operating a program to evaluate and control radiation exposure to the embryo/fetus of pregnant female workers that will comply with DOE requirements.
G-10 CFR 835/E1 Instrument Calibration for Portable Survey Instruments	Provides an acceptable methodology for establishing and operating a program for calibrating portable radiological survey instruments that will comply with DOE requirements.
G-10 CFR 835/E2 Workplace Air Monitoring	Provides an acceptable methodology for establishing and operating a workplace air monitoring program that will comply with DOE requirements.
G-10 CFR 835/G1 Posting and Labeling for Radiological Control	Provides an acceptable methodology for establishing and operating a radiological posting and labeling program that will comply with DOE requirements.
G-10 CFR 835/H1 Occupational Radiation Protection Record-Keeping and Reporting	Provides an acceptable methodology for establishing and operating an occupational radiation protection record keeping and reporting program that will comply with DOE requirements.
G-10 CFR 835/J1 Radiation Safety Training	Provides an acceptable methodology for establishing and operating a radiation safety training program that will comply with DOE requirements.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
DOE N 441.2 Extension of DOE N 441.1, Radiological Protection for DOE Activities	Establishes radiological protection requirements that, combined with 10 CFR 835, form the basis for a comprehensive radiation protection program. Elements of this DOE Notice are included in a proposed amendment to 10 CFR 835.
*DOE O 5820.2A Radioactive Waste Management	Provides DOE policies, guidelines, and requirements for the management of DOE radioactive waste, mixed waste, and contaminated facilities.
DOE G-N5400.9/M1 Sealed Radioactive Source Accountability and Control	Provides an acceptable methodology for establishing and operating a sealed radioactive source accountability and control program that will comply with DOE requirements. This also applies to radiography sources.
DOE-STD-1107-97 Knowledge, Skills and Abilities for Key Radiation Protection Positions at DOE Facilities.	Provides guidance on the knowledge skills and abilities of personnel who implement DOE radiation protection programs.
Nuclear (Thresholds Above Category 3)	
*10 CFR 820 Procedural Rules for DOE Nuclear Activities	Provides procedures to govern the conduct of persons involved in DOE nuclear activities and, in particular, to achieve compliance with DOE nuclear safety requirements by all persons subject to those requirements. This part sets forth the procedures to implement the provisions of the Price-Anderson Amendments Act of 1988, which subjects DOE contractors to potential civil and criminal penalties for violations of DOE rules, regulations, and orders relating to nuclear safety.
*10 CFR 830 Nuclear Safety Management	Provides requirements for the conduct of the DOE management and operating contractors and other persons at DOE nuclear facilities. This part establishes requirements for the safe management of DOE contractor and subcontractor work at the Department's nuclear facilities. The current rule adopts the sections that make up the general applicable provisions and also adopts the specific section on provisions for developing and implementing a formalized quality assurance program.
DOE-STD-1083-95 Requesting and Granting Exemptions to Nuclear Safety Rules	Provides guidance for requesting exemptions to nuclear safety rules.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
*DOE 5480.18B Nuclear Facility Training Accreditation Program	Provides requirements for establishing and implementing a nuclear facility training accreditation program.
*DOE 5480.19 Conduct of Operations Requirements for Nuclear Facilities	Provides requirements for establishing and implementing a conduct of operations program.
*DOE 5480.20A Personnel Selection, Qualification, and Training Requirements for Nuclear Facilities	Provides requirements for establishing and implementing personnel selection, qualification, and training requirements.
*DOE 5480.21 Unreviewed Safety Questions	Provides requirements for performing unreviewed safety question (USQ) determinations.
*DOE 5480.22 Technical Safety Requirements	Establishes the requirement to have technical safety requirements (TSR) prepared for DOE nuclear facilities and delineates the criteria, content, scope, format, approval process, reporting, and revision requirements of these TSRs.
*DOE 5480.23 Nuclear Safety Analysis Reports	Establishes requirements for developing safety analyses that establish and evaluate the adequacy of the safety basis of the facilities. The safety analysis report (SAR) required by this Order documents the results of the nuclear safety analysis.
DOE-STD-1104-96 Review and Approval of Non-reactor Nuclear Facility Safety Analysis Reports	Provides guidelines for conducting reviews of DOE 5480.23 SARs.
DOE-STD-1027-92 Hazard Categorization and Accident Analysis Techniques for Compliance with 5480.23	Provides guidance for the preparation and review of hazard categorization and accident analyses techniques as required by DOE 5480.23.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
DOE-STD-3009-94 Preparation Guide for U.S. Department of Energy Non-reactor Nuclear Facility Safety Analysis Reports	Provides format and content of SARs for Non-reactor nuclear facilities. Chapter 3 provides specific guidance for hazards analysis.
DOE-STD-3011 Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans	Specifies format and content for developing bases of interim operation (BIOs).
DOE-HDBK-3010-94 Release Fractions and Respirable Fractions for Nuclear Facilities	Provides airborne release fraction (ARF) and respirable fraction (RF) values for use when performing hazard/safety analysis.
DOE-EM-STD-5502-94 Hazard Baseline Documentation	Provides a methodology for classifying facilities under EM's purview. Upon issuance of DOE-STD-1120-98, DOE-EM-STD-5502-92 will be retired.
*DOE O 420.1 Facility Safety	Establishes facility safety requirements related to nuclear safety design and criticality safety.
DOE-STD-3007-93 Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities	Provides guidance for preparing nuclear criticality safety analysis of DOE operations.
*DOE O 425.1 Startup and Restart of Nuclear Facilities	Provides requirements for startup of new nuclear facilities and for the restart of nuclear facilities that have been shutdown.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
DOE-STD-101-92 Nuclear Safety Criteria for Potential Application to Non-reactor Nuclear Facilities	Provides a listing of nuclear safety criteria that may be applicable to non-reactor nuclear facilities.
DOE-STD-3013 Criteria for Preparing and Packaging Plutonium Metals and Oxides for Long-Term Storage	Provides guidance for assuring safe storage of plutonium metals and oxides for 50 years or final disposition.
PHYSICAL	
*29 CFR 1910 S&H Regulations for General Industry	*General Industry* Sets forth the safety and health (S&H) standards promulgated by OSHA for general industry.
*29 CFR 1926 S&H Regulations for Construction	*Construction* Sets forth the S&H standards promulgated by OSHA for construction, alteration, and/or repair, including painting and decorating.
Fire	
DOE G-420/G-440.1 IG for DOE 420.1 and 440.1 Fire Safety Program	Provides guidance to facilitate the development, implementation, and maintenance of a comprehensive fire protection program that meets the requirements of DOE 0 420.1 and DOE O 440.1.
DOE-HDBK-1062-96 DOE Fire Protection Handbook	Provides guidance on how to achieve the fire protection requirements of DOE 5480.7A (DOE 5480.7A was canceled by DOE O 420.1).
DOE-STD-1088-95 Fire Protection for Relocatable Structures	Provides guidance on meeting fire protection requirements for relocatable structures.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
*29 CFR 1910 Subpart L Fire Protection	*General Industry* Contains requirements for fire brigades, all portable and fixed fire suppression equipment; fire detection systems; and fire or employee alarm systems installed to meet the fire protection requirements of 29 CFR 1910.
*29 CFR 1926 Subpart F Fire Protection	*Construction* Contains requirements for fire protection, including a fire protection program, flammable and combustible liquids, LP-gas, heating devices, fire suppression equipment, and employee alarm systems.
*29 CFR 1910 Subpart Q Welding, Cutting and Brazing	*General Industry* Provides requirements for gas welding and cutting, arc welding and cutting, fire prevention and ventilation and protection for welding operations.
*29 CFR 1926 Subpart J Welding and Cutting	*Construction* Provides requirements for construction operations for gas welding and cutting, arc welding and cutting, fire prevention and ventilation and protection for welding operations. This subpart would typically apply only during decommissioning.
DOE/EH-0196 Bulletin 91-3(Revised) Fire Prevention Measures for Cutting, Welding, and Related Activities	Contains requirements, standards, and guidelines governing fire safety for "hot work" activities. Among other things, requires job hazard analysis (JHA) for Deactivation and Decommissioning (D&D) work, fire retardant clothing, and fire watch to protect personnel.
Explosion	
DOE M 440.1-1 DOE Explosives Safety Manual	Primarily applicable only during decommissioning. Provides safety standards and procedures used to implement the requirements of DOE O 440.1 for operations involving explosives, pyrotechnics, and propellants, or assemblies containing these materials. With the exception of onsite explosives storage and transportation, this manual does not apply to commercial activities such as routine construction or routine tunnel blasting.
*29 CFR 1910.109 Explosives and Blasting Agents	*General Industry* Primarily applicable only during decommissioning. This regulation contains requirements for handling, storing, transporting, and using explosives and blasting agents in general industry operations.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
*29 CFR 1926 Subpart U Blasting and the Use of Explosives	*Construction* Primarily applicable only during decommissioning. This section contains requirements for the use, transportation, and storage of explosives, blasting agents, and equipment in construction operations.
Elevation	
*29 CFR 1926 Subpart L Scaffolding	*Construction* Provides requirements for the construction and use of various types of scaffolds for construction.
*29 CFR 1926 Subpart M Fall Protection	*Construction* Sets forth requirements and criteria for fall protection in construction workplaces covered under 29 CFR 1926.
*29 CFR 1926 Subpart N Cranes, Derricks, Hoists, Elevators, and Conveyors	*Construction* Covers the use, employee protection and hazard control, maintenance, testing, and equipment associated with cranes, derricks, hoists, elevators, and conveyors used for construction.
DOE-STD-1090-96 Hoisting and Rigging	Provides guidance for safely performing hoisting and rigging activities.
Electrical	
*29 CFR 1910 Subpart S Electrical	*General Industry* Addresses electrical safety requirements that are necessary for the practical safeguarding of employees in their workplaces. Includes design safety standards for electrical systems, safety-related work practices, safety-related maintenance requirements, and safety requirements for special equipment.
2*9 CFR 1926 Subpart K Electrical	*Construction* Addresses electrical safety requirements that are necessary for the practical safeguarding of employees involved in construction work. Includes installation safety requirements, safety-related work practices, safety-related maintenance and environmental considerations, and safety requirements for special equipment.
*29 CFR 1910.333 Selection and Use of Work Practices	*General Industry* Details requirements to prevent electric shock or other injuries from work on or near electrical equipment. Includes provisions for locking and tagging out circuits.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
*29 CFR 1926.417 Lockout and Tagging of Circuits	*Construction* Provides requirements and procedures for locking and tagging controls and circuits when an employee is exposed to contact with deactivated electric equipment or circuits.
DOE-STD-1030-96 Guide to Good Practices for Lockouts and Tagouts	Provides guidance on good practices associated with lockouts and tagouts.
Confined Space	
*29 CFR 1910.146 Permit-required Confined Spaces	*General Industry* Contains requirements for practices and procedures to protect employees in general industry (excluding construction) from the hazards of entry into permit-required confined spaces. Requirements include a Permit Space Program.
*29 CFR 1926 Subpart P Excavations	*Construction* Primarily applicable only during decommissioning. Contains requirements for the protection of employees working in and around all open excavations (including trenches) and requirements for protective systems (e.g. , sloping, shield systems, etc.).
Others	
*29 CFR 1910 Subpart Q Welding, Cutting and Brazing	*General Industry* Provides requirements for gas welding and cutting, arc welding and cutting, fire prevention and ventilation, and protection for welding operations.
*29 CFR 1926 Subpart J Welding and Cutting	*Construction* Provides requirements for construction operations for gas welding and cutting, arc welding and cutting, fire prevention and ventilation, and protection for welding operations.
*29 CFR 1910.94 Ventilation	*General Industry* Provides requirements for ventilation for abrasive blasting, grinding, polishing and buffing operations, spray finishing operations, and open surface tanks.
*29 CFR 1926.57 Ventilation	*Construction* Provides requirements for ventilation for abrasive blasting, grinding, polishing, and buffing operations, spray finishing operations, and open surface tanks.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
*29 CFR 1910.95 Occupational Noise Exposure	*General Industry* Establishes allowable noise levels and the protection requirements when those levels are exceeded.
*29 CFR 1926.53 Occupational Noise Exposure	*Construction* Establishes allowable noise levels and the protection requirements when those levels are exceeded.
*29 CFR 1910 Subpart O Machinery and Machine Guarding	*General Industry* Details requirements for the use, maintenance, and guarding of machinery, including mechanical power-transmission apparatus.
*29 CFR 1926 Subpart I Tools---Hand and Power	*Construction* Provides requirements for the use, maintenance, and guarding of hand and power tools, including mechanical power-transmission apparatus.
*29 CFR 1910.147 Control of Hazardous Energy (Lockout/Tagout)	*General Industry* Covers the servicing and maintenance of machines and equipment in which the unexpected energization or startup of the machines or equipment or the release of stored energy could cause injury to employees. Minimum performance requirements for the control of such hazardous energy are established. (Does not cover construction employment or exposure to electrical hazards in electric utilization installations.)
*29 CFR 1910 Subpart N Materials Handling and Storage	*General Industry* Contains safety requirements for mechanized materials handling and storage.
*29 CFR 1926 Subpart N Cranes, Derricks, Hoists, Elevators, and Conveyors	*Construction* Covers the use, employee protection and hazard control, maintenance, testing, and equipment associated with cranes, derricks, hoists, elevators and conveyors used for construction.
DOE-STD-1090-96 Hoisting and Rigging	Provides guidance for safely performing hoisting and rigging activities.

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
*29 CFR 1926 Subpart O Motor Vehicles, Mechanized Equipment, and Marine Operations	*Construction* Addresses safety requirements related to off-highway motor vehicles, earthmoving equipment, excavating and other equipment, pile driving equipment, site clearing, and marine operations and equipment.
*29 CFR 1926 Subpart P Excavations	*Construction* Primarily applicable only during decommissioning. Contains requirements for the protection of employees working in and around all open excavations (including trenches) and requirements for protective systems (e.g., sloping, shield systems, etc.).

Table A-1.

SAFETY AND HEALTH DIRECTIVES

APPLICABLE TO FACILITY DISPOSITION ACTIVITIES

Directive	Intent
*29 CFR 1926 Subpart T Demolition	*Construction* Primarily applicable only during decommissioning. Contains requirements for demolition preparatory operations, floor, wall, material, and steel construction removal, waste transport, and storage. (Does not include demolition by explosives, which is in Subpart U.)
BIOLOGICAL	
Bloodborne Pathogens	
*29 CFR 1910.1030 Bloodborne Pathogens	*General Industry* Contains requirements to control occupational exposure to blood and other potentially infectious materials. Stipulates methods to comply with exposure control, hazard communication procedures, and recordkeeping requirements.
Others	
*29 CFR 1910.141 Sanitation	*General Industry* Includes requirements for water supply, housekeeping, waste disposal, insect and vermin control, and other provisions that reduce the potential spread of infectious agents, including rodent-borne and insect-borne hazards.
*29 CFR 1926.51 Sanitation	*Construction* Includes requirements for water supply, housekeeping, waste disposal, insect and vermin control, and other provisions that reduce the potential spread of infectious agents, including rodent-borne and insect-borne hazards.

Appendix B

Overview of the Work Smart Standards Process

The Work Smart Standards Approach to Facility Disposition

Introduction

The Work Smart Standards (WSS) approach is used to reach agreement between the Department of Energy (DOE) and its contractors pertaining to the standards to be followed for doing work safely. WSS was approved for use in January 1996 and issued as policy in DOE P450.3, *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*.

"Work Smart" is consistent with the seven principles of Integrated Safety Management (ISM) and includes the first three functions of ISM—define work, analyze hazards and develop/implement controls. At a number of DOE sites, Work Smart has been chosen as the preferred approach to identifying standards and initiating ISM implementation. It is a bottom-up approach that involves DOE and the contractor personnel who actually perform the work, along with relevant stakeholders, as members of multidisciplined teams. These teams, with guidance and direction from management, perform the technical analysis of the work and hazards, then select the standards needed to control the work. These standards are then confirmed by an independent confirmation group (often including external experts from industry and academia) and approved by DOE and contractor management.

This appendix provides an overview of the WSS process for developing a necessary and sufficient set of standards. The process objectives discussed include (1) defining the work and hazards, (2) creating the team(s), (3) defining and agreeing to protocols and documentation for the team(s), (4) identifying the necessary and sufficient set of standards, (5) confirming the set of standards, and (6) approving the standards and authorizing their use.

Objective: Define the work and performance expectations to which the standards apply.

Clearly defining the work performance expectations, work environment, and associated hazards (with the corresponding uncertainties) is critical to identifying the applicable standards set. Defining the work and hazards involved provides an opportunity to determine if the hazards can be reduced or eliminated by using alternate approaches or work methods. Tailoring the standards set to the work and hazards ensures that the desired level of protection is efficiently achieved.

Implementation of this objective is achieved through the use of a Convened Group, a multidisciplined group of individuals and stakeholders, and a process leader. The Convened Group serves as the steering group for the performance of the process and is selected from the lowest level of management responsible for managing the resources and the work affected by the standards set. Members must be empowered to make the necessary commitments for the organizations that they represent. The Convened Group is responsible for designating the Identification Team, the Conformation Team, and the Approval Authority. The process leader is responsible for acquiring information related to the work, organizing the information on an initial basis, and re-evaluating the work definition (on the basis of feedback received during the process).

Objective: Create team(s) to identify a standards set and confirm both the set's adequacy and feasibility.

The identification of the standards set and its confirmation for use are based on the judgement of subject matter experts and stakeholders. Teams are formed to establish that the standard set is adequate and the set provides a basis for adequate protection. The level of formality and independence of the confirmation process depends on the nature, complexity, hazards, and uncertainties involved with performing work activities. Criteria for selecting team members and the specific qualification for members of both the Identification and Confirmation Teams also relates to the nature, complexity, hazards, and uncertainties involved with performing work activities. Due to statutory limitations, only DOE/Federal employees, DOE contractor employees and subcontractor employees may be used on the Identification and Confirmation Teams.

The Convened Group is responsible for implementing this objective by developing the specifications and specific qualifications of the Identification and Confirmation Teams, and by assuring the availability of identified personnel.

Objective: Establish protocols, agreements, and documents for a credible and efficient process.

To a great extent, the formality and extent of documentation depends on the nature and complexity of the work activities to be performed, the potential impact of the identified hazards and related uncertainties potentially encountered during the performance of the work, and the quality and rigor to ensure that the identified standards will meet the performance expectations and successfully accomplish the work to be performed.

The Convened Group is responsible both for establishing the process protocols and agreements and for establishing the required level of documentation. The process leader is responsible for establishing the detailed team protocols, including the roles and responsibilities of team members; orienting the team members on the process; developing procedures and management plans; resolving team comments; and acting as the point-of-contact with organizations outside of the process.

Objective: Identify and reach consensus on the proposed standards set.

The Identification Team is responsible for identifying a set of standards that is necessary for the work and is sufficient to protect the public, workers, and the environment based on the team's collective experience. The primary responsibilities of the team include identifying any additional information needed to define the work, evaluating sources of standards, and determining which standards constitute a necessary and sufficient set. Also the team is responsible for identifying team assumptions used in identifying the set, identifying statutes and implementation regulations that are required to be included (but do not add value), providing a justification for the development of future exemptions, and reaching consensus on the proposed set of standards. Where it is not possible to reach an agreed-upon standards set, the team needs to recommend changes to the work or standards that would allow a necessary and sufficient set to be identified. The Identification Team is also responsible for documenting the agreed-upon standards set, supplying justification for their choices, identifying and implementing assumptions, and providing justifications to support exemptions, where appropriate.

Objective: Confirm the adequacy and sufficiency of the proposed standards set.

The Confirmation Team is responsible for reviewing the set of standards and other supporting documentation, determining if the proposed standards set is both adequate and feasible and the requisite documentation is sufficient, and documenting the confirmation activities and the results.

Objectives: To accept the level of protection provided by implementation of the standards set and to authorize the use of the standards set, subject to implementation assumptions.

Approval constitutes both agreement with the set of standards proposed and acceptance of the level of protection provided by the standards. The approval also signifies that there is an organizational commitment to provide or seek the requisite resources to implement the proposed standards set. The Approval Authority previously identified by the Convened Group is responsible for determining whether the process was correctly implemented and documented (in accordance with established protocols), whether the Identification Team has chosen and justified a sufficient set of standards, and whether the

Confirmation Team has confirmed the feasibility and adequacy of the standards. The Approval Authority then determines the adequacy of the standards and informs the Convened Group of its decision

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Appendix C

Safety Management Performance Expectations

SAFETY MANAGEMENT PERFORMANCE EXPECTATIONS

These performance expectations are derived from the guidance contained within Volume 1 of this *Standard*. Project managers may use these performance expectations to develop a tailored set of project-specific performance measures.

PERFORMANCE EXPECTATIONS
3.1 Work Planning and Hazard Identification *Integrating Safety and Health into Work Planning Activities* • Multidisciplined project team, including Industrial Hygiene (IH), Industrial Safety (IS), Construction Safety (CS), Health Physics (HP), Facility Safety, Emergency Preparedness (EP), Fire Protection (FP), Waste Management (WM) specialists and workers, is used to evaluate available facility data (budget, schedule, existing S&H documents, etc.) and prepare a project plan. • Stakeholders issues/expectations are clearly understood and reflected in project planning activities. • The project plan defines S&H requirements and standards, performance measures and metrics, Integrated Safety Management System (ISMS) approach, S&H responsibilities, and safety management strategy. • The project plan specifies an approach for ensuring subcontractor S&H programs are adequate, in place, and monitored. • For decommissioning projects, an evaluation is made of the Comprehensive Environmental Response Compensation and Liabilities Act (CERCLA) provisions and a strategy is developed for integrating S&H activities, documentation, and review and approval required by DOE directives. • Work packages are prepared during the planning of specified work tasks, using first line supervisors, workers, and safety personnel, and include the description of task; identification of task hazard analysis required, information developed from task hazard analyses and verification that they have been performed; training required; necessary work permits; equipment and materials to be used; facility areas where task will be performed; and emergency response actions.

PERFORMANCE EXPECTATIONS

3.1 Work Planning and Hazard Identification (con't)

Resource Planning

- Site work is identified and priorities are balanced. Resources are effectively allocated to address safety and health, programmatic, and operational considerations. Protecting the public and workers is a priority when activities are planned and performed (i.e., safety and health risk of the workers and public will not be compromised, with a high priority placed on managing and reducing risks in the workplace, as well as reducing risks to the public).

- Environmental Safety and Health (ES&H) support required for the project work scope and the associated skill mix and funding required to adequately provide this support is identified.

- Site/project S&H issues and vulnerabilities (including skill mix and funding issues) are identified and strategies for addressing these issues are presented.

PERFORMANCE EXPECTATIONS

3.1 Work Planning and Hazard Identification (con't)

Hazard Identification and Characterization

- All relevant information describing the facility and hazard is collected. Valuable sources include hazard baseline documents, such as safety analysis reports (SARs); technical safety requirements (TSRs); health and safety plans (HASPs); Environmental Impact Statements (EISs); design documents; operational records; purchasing records; Material Safety Data Sheets (MSDSs); medical and environmental reporting data; and Unusual Occurrence Reports (UORs).

- Current and past facility employees are interviewed to gather information not evident from document reviews.

- Walkdowns are performed using a multidisciplined project team to assess and confirm existing facility conditions and inherent hazards.

- A determination is made on the need for additional characterization based on level of uncertainty regarding knowledge of hazards (e.g. hazardous material type, form, quantity, and locations).

- Planning assumptions such as planned work scope and end-points are confirmed to ensure they are supported by the additional information gained from facility hazard identification and characterization.

- Intrusive characterization activities are performed as necessary.

- Provisions are in place to protect workers performing facility walkdowns and characterization activities. For decommissioning projects, a characterization HASP is prepared where required by 29 CFR 1910.120.

PERFORMANCE EXPECTATIONS
3.1 Work Planning and Hazards Identification (con't) *Safety and Health Requirements Identification* • Applicable safety and health requirements are identified according to work scope and hazards and are reflected in work procedures. • A hazard categorization is performed in accordance with DOE 5480.23 and DOE-STD-1027-92 for facilities with radiological hazards. Fixed and radiological contamination or activated metals are not included in the radiological inventory for decommissioning projects.
3.2 Integrated Hazard Analysis *Facility Baseline Analysis* • A determination is made about whether existing hazard analyses can be used for current disposition activities based on the current scope of activities and the past hazard baseline. • A baseline analysis is performed by a multidisciplined team comprising (on an as-needed basis) specialists in radiological, chemical, biological, and physical hazards, as well as facility management, safety specialists, engineering, and facility disposition workers. • The baseline analysis evaluates the hazardous material types and its related inherent harmful characteristics, quantities and concentrations, form, location, and exposure mechanisms. • The baseline analysis is updated and maintained current. The need for updates should be triggered by changes in facility disposition phases, new hazards or changes to energy sources, and changes to assumptions or commitments related to the hazard baseline; availability of previously conducted hazard analyses should be made available for project team use.

PERFORMANCE EXPECTATIONS
3.2 Integrated Hazard Analysis (con't) *Task Hazard Analysis* • A task hazard analysis is conducted for specific disposition work tasks and uses the facility baseline analysis information as the starting point. • Workers, first line supervisors, and safety personnel are involved in walkdowns of the work on an as-needed basis to review job steps associated with a task and to identify workplace hazards and those associated with the chosen work methods.
3.3 Hazard Controls and Baseline Documentation *Worker Safety Controls* • S&H requirements/standards, including controls stemming from baseline documentation and commitments are effectively translated into work procedures and instructions. The strategy for establishing safety controls for facility disposition workers is consistent with the hierarchy specified in DOE O 440.1. • Operational safety commitments for each work method are clearly identified and reflected in the task work plan or package. • Personnel qualifications and training requirements are derived from the hazard analyses and are clearly specified in work packages. • Task sequences, prerequisites, and hold points related to safety and health are documented in the work package.

PERFORMANCE EXPECTATIONS

3.3 Hazard Controls and Baseline Documentation (con't)

Facility Safety Controls

- An evaluation is made based on the hazard analysis results and planning data for the facility safety controls needed during disposition activities. Existing safety controls may be retired during the course of a disposition activity when the hazardous condition controlled is no longer present, the hazardous materials are no longer present, the material's form has changed to a less dispersable form, or the quantity of material has been reduced to a level where the consequences of potential exposure are no longer a concern.

- Establishment of safety controls considers uncertainties in material inventories or hazardous conditions and uses conservative assumptions in designating controls that include hold points during the project when additional characterization and analysis will be performed.

PERFORMANCE EXPECTATIONS

3.3 Hazard Controls and Baseline Documentation (con't)

Hazard Baseline Documentation

- Hazard baseline documentation is prepared in accordance with the *Standard's* expectations for nuclear and non-nuclear facilities and is used in conjunction with the project plan to authorize disposition activities to proceed.

- Hazard baseline documentation clearly reflects disposition work scope and anticipated hazards and their associated controls, including equipment safety functional and performance requirements, as well as administrative controls and programmatic commitments.

- For decommissioning projects, hazard baseline documentation is integrated with CERCLA (e.g., the Remedial Design Report), where applicable, and is used as the basis for satisfying both sets of safety requirements.

- Approval of the hazard baseline documents has been secured consistent with designated Program Secretarial Officer's delegation of authority protocols as well as site protocols.

- The hazard baseline documents clearly identify stakeholder and regulatory commitments.

- Information needed to be included in worker training related to controls, commitments, or operating limits has been clearly documented and transferred to the person or organization responsible for creating the training module(s).

- Changes and revisions to task scope or hazard baseline documents are documented and approved by appropriate level of contractor/DOE management and reflected in the integrated hazard analysis.

PERFORMANCE EXPECTATIONS
3.4 Perform Work *Readiness Reviews* • A readiness review is conducted that ensures all hazards have been identified, S&H requirements have been met, and safety systems and controls are in place and functional. • Workers are qualified to perform the required task(s) and understand hazards and controls. • Permits and procedures are in place and controls are operable. • Work authorization is obtained. • Verification of the resolution of applicable readiness assessment findings is completed.
Maintenance of Change • For both nuclear and non-nuclear facilities, a change control process should be employed that evaluates changes to work plans, procedures, and impacts from unforseen hazards. Processes should encompass screening of all changes, the evaluation of changes to hazards and controls, verification that the changes are within the existing hazard baseline, and specification of actions necessary if change is outside of the hazard baseline. • For nuclear facilities, tasks are screened against seven questions defined in DOE 5480.21, Section I.V.2.b, to determine whether they represent a potential unreviewed safety question (USQ).

PERFORMANCE EXPECTATIONS
3.5 Feedback • Feedback mechanisms are in place and include monitoring and self-assessment. • Performance monitoring reflects appropriate and measurable S&H indicators and measures that encompass integrated safety management activities. • Self-assessment of the S&H program is performed periodically and includes an evaluation of both management commitments and worker involvement. • Procedures, processes, and items that do not meet established requirements are identified, controlled, and corrected. Correction includes identifying the causes of problems and preventing recurrence.

Appendix D

Examples

EXAMPLES

The following examples represent a wide diversity of facility disposition experience that includes both good practices and lessons learned. Each example illustrates implementation of safety management approaches discussed in Volume 1 and is organized according to Section 3 (i.e., work planning and hazards identification, hazard analysis, hazard controls and baseline documentation, and work execution) Further, they are drawn from across the DOE complex and reflect actual Field and Headquarters experience.

It should be noted that examples are provided to enhance the reader's understanding of concepts presented in this standard. Actual field implementation of these concepts may involve work or hazards that deviate from those reflected in individual examples. Therefore, it should not be assumed that examples are entirely representative of all aspects of an actual disposition activity (i.e., avoid rote implementation of approaches presented in examples).

Each example contains a statement of the concepts discussed in Chapter 3, associated key words, and references to the applicable section in Volume 1. Examples are organized as shown in Table D-1.

Table D-1 Organization of Examples

Ex No.	Name of Example	Chpt. 3 Safety Manage. Elements[1]					Key Words
		WP/HI	HA	HC/BD	PW	FK	
1	Assuring Accurate Identification of Credible Hazards During Activity Planning	3.1.1					Hazards identification, planning
2	Allocating Sufficient S&H Resources During Planning	3.1.2					S&H resources, planning
3	Utilizing a Multidisciplined Team to Identify Hazards During Job Planning to Support Characterization	3.1.3					Characterization, team, planning
4	Identifying and Characterizing Unknown Hazards to Protect Workers During Decommissioning	3.1.3					Characterization, HASP, hazard identification, planning
5	Using Historical Information and Experience to Identify Hazards during Facility Characterization	3.1.3					Characterization, historical information, employee experience
6	Utilizing Historical Knowledge to Increase Efficiency of Site Characterization Activities	3.1.3					Historical infomation, site characterization,
7	Using a Multidisciplined Team for Hazard Identification	3.1.3					Hazard Identification, planning

Ex No.	Name of Example	Chpt. 3 Safety Manage. Elements[1]					Key Words
		WP/HI	HA	HC/BD	PW	FK	
8	Using Computerized Screening Tool for Job Hazard Analysis	3.1.3					Job hazards analysis, JSA, HAZOP
9	Hazard Categorization and Specification of Hazard Baseline Documentation for Facilities with Fixed Radiological Contamination	3.1.4					Fixed contamination, hazard identification
10	Using a Preliminary Hazard Screening/Assessment to Determine the Degree of Analysis Required		3.2.2				Preliminary Hazard Screening Assessment, hazard analysis
11	Ensuring that the Hazard Analysis Reflects Facility and Activity Hazards		3.2.1 3.2.2				Safety controls, hazard analysis
12	Screening Job Hazard Analysis Against Existing Hazard Baseline		3.2.2				JHA, worker safety, hazard analysis
13	Administrative Controls for a Non-nuclear Facility			3.3.1			Administrative controls
14	Mitigating the Effects of an Earthquake			3.3.2			Administrative controls, safety controls, hazard analysis
15	Ensuring Changes in Safety Controls, Removal of a Safety System, and Changes to Baseline Documentation are Communicated to Workers			3.3.2			Hazard baseline documentation, safety controls

Ex No.	Name of Example	Chpt. 3 Safety Manage. Elements[1]					Key Words
		WP/HI	HA	HC/BD	PW	FK	
16	Applying Hold Points in TSRs During Decommissioning			3.3.3			TSRs, hold points
17	Preparing Decommissioning Plans that Include Nuclear Safety Requirements			3.3.4			CERCLA, decommissioning
18	Using a Health and Safety Plan for Decommissioning a Non-nuclear Facility			3.3.4			Hazard baseline, decommissioning
19	Using Facility Walkdowns to Assess the Current Authorization Basis and Provide a Facility Baseline			3.3.5			SAR, authorization basis
20	Pre-job Briefing Identifies Unanalyzed Hazard				3.4		Pre-job briefing, hazard analysis
21	Lessons Learned from a Readiness Review Process				3.4.1		RA, readiness review
22	Ensuring Adequate Job Hazard Analysis and Pre-Job Briefings to Fully Identify Hazards				3.4.2		JHA, lessons learned
23	Using the Change Control Process to Assure Safe Demolition				3.4.2		Management of change
24	Self-Assessments Lead to Discovery of Deficiency					3.5	self-assessment, worker safety controls

[1]Where: WP = Work Planning; HI = Hazard Identification; HA = Hazard Analysis; FK= Feedback and Evaluation; HC = Hazard Control; BD = Baseline Documentation; PW = Perform Work

WORK PLANNING/HAZARD IDENTIFICATION EXAMPLES

Example 1: Assuring Accurate Identification of Credible Hazards During Activity Planning

As part of the task to remove useable process equipment during a facility decommissioning, a welder was using a cutting torch to cut out large cylindrical sections. The work was similar in many ways to work performed in another building at the site during the past year, as well as to extensive equipment replacement activities necessary to support operations in the past. Because of these similarities the operating contractor classified the work as routine maintenance, thereby eliminating the requirement for a task-specific work plan.

Concept: Importance of identifying all credible worker and facility hazards during work planning.

Key Words: Hazards identification, planning

Reference: Volume 1, Section 3.1.1

During the cutting operation a spark or piece of hot metal ignited the welder's coveralls below the left knee. The welder was wearing multiple layers of clothing, radiological protective equipment, and a welder's mask that severely limited his ability to detect and extinguish the flames. Since the welder was working alone, the flames spread undetected until they were beyond his ability to extinguish them without assistance. By the time a co-worker responded to the emergency, the flames had totally engulfed the welder's body. He received third-degree burns on more than 95 percent of his body and died the following day.

The Type A Accident Investigation Board Report notes several deficiencies that contributed to the fatality—failure to identify a fire watch with appropriate personal safety responsibilities and training; failure to plan the work adequately; failure to react to numerous clothing fires during welding prior to the accident because of a failure to foster an atmosphere that encouraged reporting of incidents; use of protective equipment that exacerbated the fire hazard; ignoring a formal lessons-learned report from identical activity the prior year; inadequate provisions for emergency egress; and failure to notify the Industrial Hygiene (IH) Department for surveying as required by the work permit. None of these required the elaborate or extensive analysis usually associated with a Safety Analysis Report (SAR)— just adherence to normal industrial safety practices, plant procedures, and the presence of an effective safety culture emphasized by management.

Example 2: Allocating Sufficient Safety and Health (S&H) Resources During Planning

Concept: Develop S&H resource requirements for ISMS core safety functions when planning facility disposition activities.

Key Words: S&H resources, planning

Reference: Volume 1, Section 3.1.2.

A facility disposition project was unable to meet the schedule for performing work because a supporting criticality analysis could not be done. The project manager was informed that a site criticality engineer was not available. To obtain the criticality expertise, the project manager could either establish a contract for these services with outside consulting companies or wait until the site's existing criticality staff could perform the analysis. The site severely reduced the criticality staff as part of a site reduction in force (RIF), which was carried out without considering the minimum skill mix requirements of the site's mission and planned work scope, including maintaining adequate criticality expertise. This caused a shortage of criticality experts in the ensuing year, which resulted in site projects being delayed. It also resulted in the new hiring of staff, and in some cases rehiring staff at higher consulting rates, to obtain the needed criticality expertise. The net result was that projects were delayed, the cost of the criticality analysis support was greater than anticipated, and worker safety could have been compromised without the availability of these services. To avoid this inefficient and costly situation, the site Environmental Safety and Health (ES&H) Management Planning Process should have been used to identify the proper skill mix required for the planned work scope to ensure that the site maintained the required ES&H capabilities, even during the RIF. Using the ES&H Management Planning Process, the projects at the site and their associated S&H funding and resource requirements would have been identified. Further, this process should have identified the vulnerability associated with a severe reduction in the criticality expertise.

Example 3: Utilizing a Multidisciplined Team to Identify Hazards During Job Planning to Support Characterization

Concept: Utilization of an integrated team of personnel comprising all the technical disciplines expected to be required to identify hazards during planning.

Key Words: Characterization, team, planning

Reference: Volume 1, Section 3.1.3

The project involved decontamination and demolition of a manufacturing facility with a floor space of 120,000 ft^2 that included metallurgical processing and fabrication of uranium metal components. An initial inspection showed the potential for chemical, radiological, and asbestos contamination throughout the building where the structural integrity was suspect. Of major

importance for decontamination within the structure and eventual demolition of the structure was the condition of the roof.

For Decommissioning planning purposes it was necessary to characterize the roof and associated support structures, particularly for radiological contamination and asbestos composition of insulation. This would require access to the roof. Before initiating characterization activities, a licensed structural engineer completed a structural inspection and evaluation. This evaluation determined that 70 percent of the roof area and associated structures was not sufficient to support personnel egress. The evaluation identified pathways that were sound and structural supports that could be used to attach personnel fall protection. Access control was established for entry onto the roof. This was coordinated with the radiation protection and industrial hygiene specialist to assure that adequate access would be available to complete the additional characterization activities necessary to support decommissioning planning.

As a result of the integrated approach, with emphasis on structural integrity as significant to worker safety, the characterization activities and the subsequent decontamination and structural demolition activities were planned and executed with no worker injuries or lost time accidents and with no releases of hazardous materials to the environment.

Example 4: Identifying and Characterizing Unknown Hazards to Protect Workers During Decommissioning

A former chemical processing facility was to be decommissioned. Because insufficient facility and hazardous material inventory information existed, extensive facility and hazard characterization efforts were needed. It was determined that to comply with HAZWOPER, a characterization Health and Safety Plan (HASP) was required to support this work.

Concept: Ensure that characterization adequately identifies the type and extent of hazards to protect workers during decommissioning.

Key Words: Characterization HASP, hazard identification, planning

Reference: Volume 1, Section 3.1.3

First, a search of available facility information was conducted. This included a review of floor plans (as many years as available), process flow diagrams (including engineering controls), environmental permits, notifications and release reports, ES&H reports (correspondence and reports), chemical and toxic release inventories, hazardous waste manifests and annual reports, utility plans, and regulatory citations.

A sampling plan was then developed, and the facility was physically inspected to assist in determining the level of protection required for samplers. An inspection of the process areas was completed to determine the present status of the facility, operations and systems. One key aspect of the sampling focused on process residues and stains that needed to be sampled and other potential contamination pathways, such as ventilation systems and air movement pathways. The HASP developers inventoried the building materials looking at the types of surfaces to determine if asbestos or lead based paint were present and inventoried the utilities to identify any lockout/tagout issues and to locate piping and ventilation systems and PCB reservoirs. Personnel protective measures selected were commensurate with the hazards and activity to be performed as defined by 29 CFR 1910.120.

The chemical inventories were assessed to determine the present condition of the materials that were to be sampled. During one activity it was determined that mercury in an assembly had been chemically altered over the past 25 years. HASP developers evaluated the interactions of such materials that were left in place and ensured that these materials were sampled and analyzed.

Further, task-specific HASPs were prepared for all work performed involving hazardous substance/waste work during this phase of decommissioning. Detailed requirements were not specified in the HASP because the requirements could be found in site safety and health program documents. Emphasis placed on elements of the HASP were commensurate with the hazards and activity to be performed and the need for protection. Training of the employees was an important, continual activity that was planned for in the HASP during characterization activities.

Example 5: Using Historical Information and Experience to Identify Hazards During Facility Characterization

Facility characterization is a critical element to the success of a facility disposition project. During the planning of characterization activities for the decommissioning of a surplus test reactor building, a historical research effort into past hot cell programmatic operations revealed the following key information directly applicable to the sampling and analysis planning.

(1) Historical reports provided information on the nature of the materials inspected in the hot cells. Inspections and

Concept: Utilize historical information and personnel experience whenever possible to develop a comprehensive profile of hazards.

Key Words: Characterization, historical information, employee experience

Reference: Volume 1, Section 3.1.3

handling of nuclear fuel containing significant quantities of fission products and loose alpha contamination were of major concern.

(2) Facility descriptions and operational procedures highlighted the use of an underground hot waste catch tank fed from hot cell drains.

(3) Interviews with programmatic personnel who had worked in the area more than 10 years ago identified the use of hazardous cleaning solvents on hot cell materials and the routine practice of flushing liquids and debris down the hot cell drains to the hot waste catch tank.

This information was critical in the planning and execution of the survey and sampling activities. It ensured that the difficult sampling of the catch tank was sufficient to support the waste disposal issues of remote-handled, transuranic-mixed waste and that the health and safety of the worker performing characterization were assured through adequate pre-planning and preparation. Without the historical information, a limited survey and sampling effort would probably have missed the mixed waste issue initially and failed to quantify the significant quantities of transuranic materials in the underground storage tank. This would have resulted in a schedule delay of at least 3 months to re-plan, re-sample and analyze the catch tank, as well as additional costs and increased potential for worker risk.

Example 6: Utilizing Historical Knowledge to Increase Efficiency of Site Characterization Activities

During the deactivation of a chemical tank farm, up-to-date facility records were unavailable. (This is a generic problem facing many DOE sites because institutional knowledge of DOE operations is being lost due to retirement of aging facility workers and reductions of the workforce at surplus facilities.) Given this situation and the poor operating records at many DOE sites, extensive site characterization sampling activities are often necessary before initiating cleanup activities. A notable cost-reduction S&H activity, which many DOE sites are performing, is to capture process knowledge from former employees. The mechanisms for this activity include producing plant history documents, hiring former employees as consultants, and sponsoring reunions of former employees. In most cases, the cost for using former employees negated the expense of having to take and analyze "hundreds" of environmental samples.

Concept: Utilization of historical knowledge increases efficiency during site characterization activities.

Key Words: Historical information, site characterization

Reference: Volume 1, Section 3.1.3

Example 7: Using a Multidisciplined Team for Hazard Identification

A project team was assembled to address the removal of enriched uranium deposits in shutdown process equipment. Initial hazard analysis had been performed to identify the generic hazards associated with these activities. Further planning and hazard identification was to be conducted for each task associated with specific equipment and material removal activities.

Concept: Use a multidisciplined team to increase the effectiveness of hazard identification.

Key Words: Hazard identification, planning

Reference: Volume 1, Section 3.1.3

The tasks that were identified included the saw-cutting of pipe sections, scraping, vacuuming/collecting uranium in geometrically safe containers, and welding seals in process openings. A multidisciplined team, comprising craft persons, supervisors, health and safety representatives, and project personnel, was assembled. The team discussed a detailed draft work plan, line by line, to determine its adequacy. Workers provided suggestions for modifications to ease or clarify the tasks discussed. Health and safety personnel provided recommendations on worker protection or removal of unnecessary requirements. The project had a completed work plan in a minimal amount of time. Additional hazards were identified and addressed based on facility walkdowns, and subsequent changes were made to the work plan. This information was then used to incorporate health and safety requirements into the work scope, performance of the job hazard analysis, and the subsequent special permits (i.e., safety work permits, radiation work permits, hot work permits, etc.).

Example 8: Using Computerized Screening Tool for Job Hazard Analysis

A job hazard analysis (JHA) computerized hazard screening tool was developed to support deactivation of a plutonium processing facility. The JHA tool was developed for use by work teams during the work planning process and was designed to serve three main functions: (1) to assist work teams in identification of hazards and appropriate controls; (2) to identify the need for involvement of safety professionals to ensure that the controls are addressing the hazards; and (3) to identify tasks that require additional analysis, such as a Job Safety Analysis (JSA) or HAZOP.

Concept: Automation of JHA increases the effectiveness and efficiency of hazard screening and identification.

Key Words: Job hazard analysis, JSA, HAZOP

Reference: Volume 1, Section 3.1.3

The JHA tool consists of several screens, each addressing a separate type of hazard (nuclear safety, industrial safety, industrial hygiene, radiological). These screens include a preliminary hazard screening/assessment (PHSA) used to determine the need for additional analysis and an initial screen which identifies whether the task requires a full JHA evaluation. In cases where the work is routine (i.e., skill of the craft with approved radiological controls and no permits required, such as cutting and welding, a full JHA is not required.

Work teams used the JHA screening tool while planning deactivation work activities. They were able to identify the hazards and appropriate controls and to estimate the level of safety professional involvement needed. One key to this process was that fact that the workers who would be performing the work were involved in the hazard screening process. The output from the process was later used in the pre-job briefing to ensure that all workers were aware of the hazards and controls.

Using this process, the incidents of lost work day injuries decreased significantly during the deactivation project. The attention of the workers to the work and the environment in which the work was to be performed increased when the computerized JHA tool was used.

Example 9: Hazard Categorization and Specification of Hazard Baseline Documentation for Facilities with Fixed Radiological Contamination

Hazard identification activities for a fully deactivated U-235 processing facility, which is initiating decommissioning, have determined that the residual fissile material exists in the forms and quantities identified in the table below.

Location	Form	Quantity
Ventilation Ductwork - distributed over 300 ft	Loose oxide powder	10 kg U-235 (98% enriched) negligible quantities of other isotopes
Building walls and floor	Smearable surface contamination	850 dpm/100 cm^2 alpha
Building walls and floor	Fixed contamination	9,000 dpm/100 cm^2 alpha
Vault/storage area	Oxides, salts, residues	1875 kg U-235

The amount of U-235 that is held up as surface contamination does not need to be included in the hazard categorization determination because it meets the definition of fixed contamination that is provided by tables 2-4 and 2-2 of the DOE *Radiological Control Manual* (DOE/EH-256T). (It is important to note that the time-consuming exercise of determining the quantity of material on the walls is no longer necessary.) A nuclear criticality safety evaluation indicated that a criticality is neither credible in the ventilation system, due to the wide dispersal of the material, nor in the vault, due to the physical forms of the materials. Hence, this facility is categorized as a radiological facility because the total inventory of 1885 kg U–235 contained in both the vault and the ventilation system is below the DOE-STD-1027-92 U-235 category 3 threshold quantity (i.e., 1,900 kg) and the remaining material is in the form of fixed contamination. Refer to Figure 3 of Volume 1, *Hazard Baseline Documentation*, where the appropriate hazard baseline document for radiological facilities undergoing decommissioning is identified as a HASP.

Concept: It is unnecessary to include fixed contamination when determining radiological inventories for hazard categorization purposes.

Key Words: Fixed contamination, hazard identification

Reference: Volume 1, Section 3.1.4

HAZARD ANALYSIS EXAMPLES

Example 10: Using a Preliminary Hazard Screening/Assessment to Determine the Degree of Analysis Required

A plutonium processing facility is entering deactivation, and facility management decided to carry out a task-based hazard analysis process. To ensure that the analysis was appropriately graded, a PHSA process was implemented. The PHSA tool consisted of two major parts. The first was designed as a general checklist to identify the characteristics of the activity and the perceived risk. The second part consisted of several questions designed to better define the hazards associated with the proposed activity.

Concept: Utilize a PHSA to determine the extent of hazard analysis required.

Key Words: PHSA

Reference: Volume 1, Section 3.2.2

One example work task analyzed was transfer of contaminated nitric acid from large tanks to tanker trucks for shipment. The PHSA screening form was completed by the cognizant engineer and a safety analyst. Part one of the screening indicated that the task was complex, large, and involved chemical, radiological, and physical, hazards. In many cases, a single failure could result in hazard exposure of the workers or

environment. Part two of the screening identified the specifics regarding these hazards. Examples include the following: the material is 48 weight percent nitric acid with uranium contamination; failure of the coupling equipment may result in potential spraying employees and the surrounding area with acid; and the potential consequences may be severe to both workers and the project. As a result of the PHSA process, facility management concluded that a more detailed hazard analysis was warranted to ensure that the appropriate controls were in place to adequately prevent or mitigate hazards.

Example 11: Ensuring that the Hazard Analysis Reflects Facility and Activity Hazards

A retired tritium facility had a 200-ft-high, 10-ft-diameter, reinforced brick-lined concrete stack that was to be demolished using explosive demolition techniques. A hazard analysis was performed to identify the hazards and requisite controls related to the demolition activities. The hazard analysis also examined the stack's close proximity to several operating nuclear facilities (some of these facilities' safety class equipment was less than 300 ft away from the stack). The hazard analysis considered hazards related to stack materials of construction and hazards introduced from the chosen work method. These hazards included seismic effects, tritium explosion from the stack on impact, propagation of pressure waves, and projectiles. Additionally, the analysis was benchmarked with another similar activity at a commercial reactor site and related lessons learned from other DOE sites were reviewed.

Concept: Ensure that a hazard analysis is based on the inherent hazards associated with a facility and the work methods of choice.

Key Words: Safety controls, hazard analysis

Reference: Volume 1, Section 3.2.1 and 3.2.2

The hazard analysis identified safety controls, including the use of mobile SeaLand containers, as an additional measure to protect critical equipment within adjacent nuclear facilities from blast damage and potential projectiles. The stack was demolished well within the expected fall zone. Except for the estimate of the pressure wave from the base of the stack, all assumptions and designated controls in the hazard analysis were adequate and realistic, based on post demolition monitoring data. As the stack struck the ground and collapsed, the pressure wave was larger than expected and moved two large metal SeaLand containers several feet. The containers were also damaged from small projectiles. However, the containers successfully performed their pressure-wave barrier function and prevented damage to the adjacent facilities or components.

Example 12: Screening Job Hazard Analysis Against Existing Hazard Baseline

A plutonium processing facility is entering deactivation. Although many of the activities are closely related to the operations activities, the deactivation includes many one-time tasks performed under varying facility conditions that may lead to new or increased worker safety hazards. The work team planned work task to remove residual plutonium material from gloveboxes. As part of this process, a JHA was drafted. In order to verify that job hazards were not outside the previously identified safety envelope, the job hazard analysis results were screened against the existing hazard baseline document (i.e., SAR). The JHA identified potential hazards that included personnel radiological exposure, criticality considerations, and industrial hazards including, punctures and pinch points. Since these hazards were consistent with those encountered during glovebox operations and the controls were identified in both training and current procedures, no additional hazards analysis was warranted for the planned activity. However, to ensure that the appropriate controls were included in the work process, the review and approval of this evaluation was performed by the criticality safety representative, industrial safety, and radiological personnel. The work plan and final JHA were completed and used in the pre-job briefing to ensure that personnel understood the hazards and controls associated with the activity prior to beginning work.

Concept: Screen the JHA against the current hazard baseline documents to determine the changes required to existing baseline analysis.

Key Words: JHA, worker safety, hazards analysis

Reference: Volume 1, Section 3.2.2

Example 13: Administrative Controls for a Non-nuclear Facility

A laboratory facility with gloveboxes was to be decontaminated in preparation for long-term surveillance and maintenance. The facility hazard categorization was determined to be non-nuclear, requiring the development of a HASP. As part of the HASP, a hazard analysis was performed to identify the hazards and the requisite controls related to the decontamination activities. The hazard analysis considered hazards related to the storage of chemicals as well as those hazards introduced from the chosen work methods.

Concept: Utilize administrative controls to control the inventory of hazardous material.

Key Words: Administrative controls

Reference: Volume 1, Section 3.3.1

The hazard analysis identified three administrative controls that support and enhance existing programmatic health and safety controls. The administrative controls are included in the HASP and personnel working in the facility are trained on their use. These controls include: (1) all hazardous substances shall be inventoried, and a "living" inventory shall be maintained and updated on a weekly basis; (2) all hazardous substances to be brought into the facility, proposed activities, new (or changes to) procedures, and discoveries shall be screened and hazards-analyzed as necessary, using a management of change process; and (3) all tasks will have an initial hazard analysis performed the first time the activity is to be completed. Industrial Safety, Industrial Hygiene, Health Protection, workers, and the facility supervisor shall review and approve identified worker safety controls. In order to ensure proper implementation of these controls, all facility workers involved in the activity were to be trained (i.e., procedure review, pre-job briefing) on these safety control requirements.

Example 14: Mitigating the Effects of an Earthquake

A plutonium facility, which is scheduled to be decommissioned within the next ten years, is to be analyzed for the effects and consequences of earthquakes. As part of the integrated hazard analysis, a seismic assessment revealed a potential for structural failure of the building during a credible seismic event. The facility was in a long-term surveillance and maintenance phase, awaiting

Concept: Consider operational modifications in lieu of expensive structural modifications to mitigate the effects of natural phenomena hazards

Key Words: Administrative controls, safety Controls, hazard analysis

Reference: Volume 1, Section 3.3.2

deactivation, and contained a large inventory of releasable radioactive material in its processing cells. The hazard analysis indicated that with more than two cell cover blocks removed, the consequences of the seismic event would be unacceptable. The facility walkdown indicated that six cells were found without cover blocks in place.

Rather than instituting facility structural upgrades or modifying the facility to prevent or mitigate the additional release of material that could occur with numerous cover blocks out of place, a simple, cost-effective, solution was to reinstall the cell cover blocks on these six cells. This action allowed for the facility to remain within its analyzed safety envelope. Once the cover blocks were reinstalled, administrative controls (i.e., Technical Safety Requirements [TSRs]) were developed and implemented to ensure that cells, which contain releasable radiological material, are always covered with a cover block. This simple and practical approach avoided the potentially large costs associated with seismically upgrading the equipment and/or facility to address the discovered vulnerability.

This approach promoted: 1) a modification in operations, i.e., no cover blocks off at any time and 2) enhancing confinement integrity (reinstalling cover blocks) instead of requiring the facility to be structurally upgraded to meet the seismic requirements.

Example 15: Ensuring Changes in Safety Controls, Removal of a Safety System, and Changes to Baseline Documentation are Communicated to Workers

Concept: Ensure that changes in safety controls and safety systems are reflected in the hazard baseline documentation and are clearly communicated to workers.

Key Words: Hazard baseline documentation, safety controls

Reference: Volume 1, Section 3.3.1

A Hazard Category 2 plutonium processing facility was being deactivated. One of the objectives for deactivation was appropriate and timely removal of unnecessary facility controls and associated administrative limits applied during operation of the facility. This was accomplished by assessing the present facility configuration to determine if the original hazards still existed or if changes to the hazardous material resulted in a less dispersable or hazardous form. Specifically, because all fissionable material (except for fixed contamination on building surfaces) had been removed, the nuclear criticality alarms were no longer fulfilling a safety function and were taken out of service. Furthermore, when the plutonium reduction furnace, which uses hydrogen, was taken out of service, the instrumentation that monitored hydrogen levels in the immediate work area and the associated automatic safety controls were no longer needed. Once limits or safety systems were determined as no longer needed based on the facility/system conditions, this was documented, through the management of change process, as an update to the baseline

hazard analysis and the limit and corresponding safety system were "retired." This documentation ensured that the operations personnel were aware of the current status for all limits associated with the deactivation facility/project and that resources were not expended on systems and controls that no longer served a safety function.

Example 16: Applying Hold Points in Technical Safety Requirements(TSRs) During Decommissioning

A Category 2 plutonium processing facility has been retired for more than 30 years and is being prepared for final decommissioning. The facility has been flushed and deactivated to its current inventory of about 2 kg Pu-239, which has been determined to be mostly fixed contamination and metal within the process systems. Approximately 1.5 kg of this material is contained within six small process vessels. There is potential for significant uncertainty in total inventory, due to the inability to assay structure, systems, or components (pipe trench, etc.) beyond the pipes and vessels immediately accessible.

Concept: Utilize hold points in TSRs to facilitate additional assay and/or analyses to confirm assumptions and to verify inventory uncertainties.

Key Words: TSRs, hold points

Reference: Volume 1, Section 3.3.3

TSRs prepared for inventory and criticality control were designed to be applied to facility modes of operation. Imbedded within the TSRs are several "hold" points that facilitate additional assay and/or analyses to confirm assumptions used in the derivation of TSRs and to verify inventory certainties. Once the six process vessels are removed and all required confirmations and approvals are complete, the limiting conditions of operations (LCOs) contained within the TSRs that are associated only with this "mode" are no longer applicable. Additional TSRs are applicable during the subsequent "mode," including more detailed characterization of the pipe trench. Hold points are used throughout the activities to assure assumptions, laboratory data, analyses, and approvals are obtained prior to authorizing work.

Example 17: Preparing Decommissioning Plans that Include Nuclear Safety Requirements

A retired Plutonium Concentration Facility was decommissioned under CERCLA. The requirements of nuclear safety authorization documentation were integrated with the decommissioning plan. Nuclear safety documentation requirements were addressed in two phases of the decommissioning removal action process: (1) the Engineering Evaluation/Cost Analysis (EE/CA) and (2) the Decommissioning Plan.

Concept: Streamline decommissioning documentation by combining the Decommissioning Plan with nuclear safety requirements.

Key Words: CERCLA, decommissioning

Reference: Volume 1, Section 3.3.5

Nuclear safety objectives for the EE/CA focused on hazard identification, hazard analysis, and requirements identification. Characterization requirements were heavily influenced by the needs for criticality and accident analysis. The evaluation provided a basis to define the preferred workscope; select standards and requirements, which were incorporated into the Applicable or Relevant and Appropriate Requirements (ARARs) evaluation; and determine impact to facility hazard category.

A preliminary hazard analysis was necessary for each action alternative to demonstrate equal consideration in the EE/CA. The hazard identification and evaluation, which addressed industrial hazards as well as hazardous substances, was used to aid in the determination of nuclear facility requirements and worker safety requirements. An initial list of safety significant structures, systems, and components, subject to existing or new TSRs, should be provided during this process as should design basis commitments, necessary programmatic controls, and specific worker safety requirements.

To accommodate the scope of the integrated Decommissioning Plan, changes were made from the format guidance contained within the *EM Decommissioning Resource Guide*. Contents of the decommissioning plan included introductory, removal action and design basis, safety and health requirements, environmental management requirements, and project management and organization requirements sections. Safety and health considerations were added as appendices (e.g., HASP), whereas the TSRs were included in the S&H section of the decommissioning plan.

Example 18: Using a Health and Safety Plan for Decommissioning a Non-nuclear Facility

A 50-MW test reactor, which was thoroughly flushed in the post-operations shutdown, has been characterized, and final preparations for decommissioning the main reactor building are in progress. The reactor was given a hazard category of Radiological, in accordance with DOE-STD-1027-92.

Concept: Utilize a HASP as a hazard baseline documentation for non-nuclear facilities.

Key Words: Hazard baseline, decommissioning

Reference: Volume 1, Section 3.3.5

The original hazard baseline documentation was reviewed for applicability in the characterization and decommissioning activities. The previous operations safety analysis documents provided information and bases for some of the characterization tasks; however, these were not directly pertinent for supporting the current work. A comprehensive hazards assessment was documented, including initial hazard categorization, assumptions, controls, and safety documentation requirements for routine Surveillance and Maintenance (S&M) of the facility. The hazards assessment recognized that a HASP would be developed. The primary hazardous activity in this facility phase (asbestos removal) would be covered in the HASP and conducted according to plant procedures and programs. The HASP was developed and implemented to ensure worker safety and programmatic functions were adequately addressed and that planned non-invasive activities were analyzed and controlled. The hazards assessment and HASP were considered the hazard baseline documentation for the S&M mode.

Example 19: Using Facility Walkdowns to Assess the Current Authorization Basis and Provide a Facility Baseline

As part of the overall safety strategy developed for deactivation of a plutonium processing facility, it was determined that the existing SAR, which supported prior facility operations, would be used to establish an authorization basis for deactivation. The time estimated for removal of the remaining radiological inventory was 14 months, which was less time than that required to prepare and approve a SAR. Although a recent preliminary hazard analysis was performed on the standby configuration of the facility, this analysis and the existing SAR were inadequate in addressing worker safety issues and

Concept: Utilize facility walkdowns in combination with authorization basis documents to develop a facility baseline and inputs for establishing controls.

Key Words: SAR, authorization basis

Reference: Volume 1, Section 3.3.5

concerns. Therefore, as a condition of approving this strategy, DOE determined that a baseline assessment of worker hazards should be performed.

To achieve the baseline assessment, a facility walkdown was performed to identify worker hazards present in the current facility configuration. The walkdown was performed by a team including industrial hygiene and industrial safety personnel with worker input and assistance. Hazards were identified and documented for each facility area. During the walkdown, any transient hazards (e.g., ladders needing inspection) were communicated to the facility management for immediate resolution and other non-transient hazards, such as poor egress, were documented in a report identifying the differences between the current documented hazard analysis and the established baseline.

The hazard mapping report was used in conjunction with authorization basis documents to provide a facility baseline and input for establishing controls. Resulting data also supported planning and analysis of specific deactivation tasks and provided a basis for training workers on recognition of hazards during work execution.

PERFORM WORK EXAMPLES

Example 20: Pre-job Briefing Identifies Unanalyzed Hazard

Concept: Use a pre-job briefing to identify additional hazards and develop appropriate controls.

Key Words: Pre-job briefing, hazard analysis

Reference: Volume 1, Section 3.4

During the pre-job briefing prior to a 47,000-pound lift of a gas heater, the concern for lateral stability of the lift was identified by the crane operator. A welder had to cut the last support to free the heater and would have to perform the cutting. Based on pre-job briefing discussions, a concern was raised that if the heater moved toward the welder after being cut, it could pin him against the side wall of the heater cell. The crane operator was aware of the potential shifts and their impact to the welder involved in the activity. As a result, this hazard was evaluated by the multidisciplined team, and a successful resolution was identified. Though the process was performed informally, the team successfully identified and controlled this hazard. The lifting was delayed an hour, and bracing was installed to protect the welder. Although the heater did not physically impact the welder, the importance of this type of input from all crew members was considered significant.

Example 21: Lessons Learned from a Readiness Review Process

A readiness assessment (RA) review was conducted

Concept: Ensuring that the operating/D&D entity is positioned for a readiness review can expedite and increase the effectiveness of the process.

Key Words: RA, readiness review

Reference: Volume 1, Section 3.4.1

for a hazard category 2 nuclear facility undergoing decommissioning. An RA review, performed over an 18-month period, resulted in the development of the following lessons learned to expedite the process.

- Records, plans, and other documentation requested by the RA team should be readily available, preferably in a central location. A project document center can be maintained and controlled with record and/or distribution copies. A review, several days in advance of the RA, should be performed to verify that all of the requested information is readily available.

- Facility staff must be readily available to answer questions and to respond to the needs of the team. Additionally, a separate counterpart is needed for each team member to arrange interviews, determine activities, and resolve questions.

- Effective communications must be accomplished with the contractor on the RA expectations on drills and simulations. This avoids the contractor falling short of the RA Teams needs for an adequate assessment. An agreement of what is to be simulated and what actions will be performed should be established.

- The short, intense duration of the RA is a challenge for the individual team members. Team members (both RA and Project) must be fully dedicated to the RA effort for its duration. An understanding by the team member and management must be established as to the dedication effort.

- Efforts to gain familiarity with the facility and the project programs prior to the start of the RA are vital to the success of the effort. Site access training, facility tours, and document reviews are essential for team members to gain the necessary familiarity with the project prior to the kickoff of the RA.

- Adequate administrative support throughout the RA period is vital to the successful completion of the RA on the expected schedule. Placing all of the word processing and technical editing requirements on too few individuals creates bottlenecks and unnecessarily extends the duration of the process.

- The selection criteria for the team leader should recognize the highly visible and cross-functional leadership role that is being filled. The team leader should be a person of seniority and authority (e.g., division director) in addition to possessing the required technical background. Previous RA experience is highly desirable, particularly if many team members do not have recent RA experience.

Example 22: Ensuring Adequate Job Hazard Analysis and Pre-Job Briefings to Fully Identify Hazards

The work task involved installation of a temporary enclosure for asbestos abatement which consisted of double plastic attached to wooden 2 in. x 4 in. framing. The enclosure consisted of panels that were glued to form a seamless barrier. This glue produced a volatile off-gas during drying. This volatile off-gas was to be controlled by the operation of the temporary exhaust system attached to the enclosure.

Concept: Ensure that JHAs completely identify all hazards and the pre-job briefing reflects these hazards so that measures can be taken to implement controls prior to the performance of work..

Key Words: JHA, lessons learned

Reference: Volume 1, Section 3.4.1

During the installation, the workers inside the enclosure noted that the temporary exhaust was separating the plastic panel seams before the glue was dry. To prevent this, the temporary exhaust was shut off. During a routine inspection, a safety technician noted that the exhaust was not operating, but worker activity was continuing, including the use of unshielded electric drills to attach wooden framing. A portable explosive gas monitor was used by the technician to determine if volatile gases were present. The measurement was off-scale. The technician ordered an immediate cessation of activities and evacuation of the area. The temporary exhaust was restarted and the plastic seams began to separate again. A review of this event revealed the following:

(1) The JHA had addressed the volatile off-gas, and the temporary exhaust was provided to mitigate this. However, the use of unshielded electric motors in this environment had not been identified.

(2) The workers had not been briefed adequately on the hazards presented by the volatile off-gas nor on the importance of maintaining adequate ventilation during the drying of the glue. This resulted in a potentially explosive atmosphere.

Example 23: Using the Change Control Process to Assure Safe Demolition

Concept: Controlling and documenting changes is key to maintaining a safety work environment.

Key Words: Management of change

Reference: Volume 1, Section 3.4.2

The work task involved demolition and removal of laboratory support systems,

including removal of a subsurface floor drain system. During removal of components within the floor drain, a vertical pipe of the same diameter as the floor drain was observed. The pipe traversed from a baseplate on the floor through a false ceiling. The work supervisor assumed that the pipe was a vent for the drain and ordered its removal. No one verified that this was a vent line that penetrated through the roof.

The pipe was cut at the floor and at the false ceiling (within the contamination control tent). When the pipe was removed, a sag was noted in the ceiling. Further inspection revealed that the upper end of the pipe terminated against a roof support beam. It was then realized that the vertical pipe was a roof support, not a drain vent as originally believed. Temporary bracing was installed until a permanent vertical support was installed. No injuries or permanent damage was sustained by the roof and associated structure. Removal of this support could have resulted in a partial roof collapse. This situation could have been prevented if (1) the discovered vertical pipe would have been identified as a discrepant "as found condition" under a management of change system or (2) the proposal to remove the pipe was evaluated for potential hazards under a management of change system.

Example 24: Self-Assessments Lead to Discoveries of Deficiency

A quarterly self assessment indicated that workers were being exposed to higher than expected levels of airborne contamination when performing, what appeared to be routine decontamination of an area within a surplus plutonium facility. As part of the self assessment, the readings from building constant air monitors (CAMs) were reviewed and the information was analyzed for trends. Although no worker had been exposed to levels above DOE limits contained within the DOE Radiological Control Manual, it became apparent that the levels from this area were consistently higher than any other area within the building. Accordingly, an investigation team, which was comprised of the cognizant engineer, a health physicist, and a worker, was formed to determine the cause and develop an approach to bring the exposures ALARA (as low as reasonably achievable). The results of the investigation indicated that the building HVAC system (i.e., air conditioning and heating) was contributing to the formation of fugitive dust by allowing contamination to be continually resuspended. Three alternatives were proposed to correct this situation: (1) discontinue activities within that area, (2) have workers don respiratory protection equipment while performing work within that area, and (3) the preferred alternative of reducing the forced air into that area by installing an in-line damper. Option three was then implemented and the CAM within the area was monitored closely for the next 2 weeks and was found to be within expected acceptable values.

Concept: Utilizing the results of self-assessment to reduce the risk to workers from facility disposition hazards.

Key Words: self-assessment, worker safety controls

Reference: Volume 1, Section 3.5

Appendix E

Hazard Analysis Techniques

HAZARD ANALYSIS TECHNIQUES

This appendix provides a listing of hazard analysis techniques that may be used to support facility disposition activities. For each technique listed, the purpose and application, as well as a reference to additional information for each technique, is provided.

Technique	Purpose/Application	Ref.
Change Analysis	The identification and evaluation of hazards that may result from changes made in the workplace. Usually undertaken whenever a change in facilities, processes, procedures, or staff is proposed. This method is often combined with a variant of Job Safety/Hazard Analysis to assess hazards for preparation of work packages.	All
Failure Modes and Effect Analysis (FMEA)	An analysis of each component for its potential modes of failure, effects of failure, and detection methods. May be undertaken before initiating operations or during operations.	1,2
Fault Tree Analysis (FTA)	An analysis tool that uses deductive reasoning and graphical diagrams showing logic of the deductive reasoning process to understand how a particular failure can occur.	1,2,4
Event Tree Analysis	An analysis tool that uses inductive logic, depicted graphically, to show the potential sequences of events that follow the initiation of an accident. This sequence includes both successes and failures of functions and/or systems.	1
Hazard and Operability Study (HAZOP)	A critical assessment of component capabilities and system configurations. Used in the chemical industry, rigor and formality based upon the level of risk of operation.	1,2
Job Safety or Hazard Analysis	An analysis of each step in a job activity that is undertaken before initiating work activities to identify needed controls or after incidents to identify needed improvements in controls. Variants of this technique are often used in evaluating hazards associated with work packages or for walkthroughs of facility to identify conditions or faulty procedure that could lead to accidents, injuries, property damage, or environmental impact.	2,3, 5,6,8
Phase Hazard Analysis	An analysis of potential new hazards because of a new phase of operation or change in work crew or subcontractor on existing operations. Usually undertaken at the beginning of major phases of work. This is critical for disposition projects.	All
Target-Barrier-Hazard Analysis	An effective technique for assessing the performance capabilities of barriers that are used to control hazards.	7

Technique	Purpose/Application	Ref.
What-If Checklist Analysis	Involves the development and evaluation of checklists designed to identify hazards quickly and assess their controls. These may be administered to ensure that hazards are identified on tasks that are familiar to workers and previously analyzed.	1,2

References on Hazard Analysis Techniques

1. Center for Chemical Process Safety of the American Institute of Chemical Engineers, *Guidelines for Hazard Evaluation Procedure,* 1992.

2. System Safety Society, *System Safety Analysis Handbook - A Source Book for Safety Practitioners*, 1993

3. Occupational Safety and Health Administration, U.S. Department of Labor, *Job Hazard Analysis: A Tool to a Safer, More Healthful Workplace*, 1981.

4. W. Vesely, et. Al., U.S. Nuclear Regulatory Commission, *Fault Tree Handbook*, NUREG-0492, January 1981.

5. Flour Daniel Hanford, Job Hazard Analysis Computer Software (JHA21), 1997.

6. EG&G Idaho, DOE-76-45/29 (SSDC-19), *Job Safety Analysis*, November 1979

7. EG&G Idaho, DOE-76-45/29 (SSDC-29), *Barrier Analysis*, July 1985

8. Occupational Safety and Health Administration, U.S. Department of Labor, *Job Hazard Analysis*, OSHA 3071, 1988 (Reprint)

Appendix F

Readiness Review Checklist

READINESS REVIEW CHECKLIST

This appendix provides a readiness checklist that can be used to support facility disposition activities. The checklist is organized under the following categories:

1. Safety Basis
2. Project Plans
3. Project Procedures Manuals
4. Work Package
5. Facility Preparation
6. Support Facilities
7. Support Equipment Preparation
8. Traffic Control
9. Industrial Safety and Hygiene: Worker Protection
10. Radiation: Worker Protection
11. Environmental Protection
12. Emergency Preparedness
13. Worker Training, Testing, and Qualification
14. Subcontractors
15. Management of Change

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
I. Safety Basis: Confirm that Safety Basis Documents are Appropriate, Complete and Reviewed and Approved by Appropriate Parties			
1. Hazard Characterization Report			
2. Hazard Baseline Document (SAR, BIO, ASA)			
3. Environmental Assessment (EA, EIS)			
4. Technical Safety Requirements (TSRs)			
II. Project Plans: Confirm that the Following Project Plans have been Developed, Reviewed, and Approved by Appropriate Parties and are in Place			
1. Project Management Plan (including project organization with responsibilities, budgets and schedules, project controls program, reporting requirements, etc.)			
2. Health & Safety Plan (including asbestos abatement)			
3. Quality Assurance Plan (including Records management and retention requirements)			
4. Procurement Plan			
5. Waste Management Plan			
6. Emergency Plan (fires, releases, injuries, etc)			
7. Final Verification Plan			
III. Project Procedures Manuals: Confirm that the Following Procedures Manuals have been Developed, Reviewed, and Approved by Appropriate Parties			
1. Engineering Procedures Manual			
2. Procurement Procedures Manual			
3. Environmental, Safety, and Health Procedures Manual			
a. Personnel Exposure Control Procedures			
b. Sampling and Monitoring Procedures			
c. Instrument Calibration Procedures			
d. Hazardous Material Control (including asbestos controls)			
4. Emergency Procedures Manual			

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
a. Evacuation, Assembly, and Personnel Accounting Procedures			
b. Medical Emergency Procedures			
c. Spill and Release Control Procedures			
d. Decontamination Procedures			
5. Material Control Manual (procured items, etc.)			
a. Material Inspection and Inventory Procedures			
b. Material Packaging and Transport Procedures			
c. Material Storage and Retrieval Procedures			
IV. Work Package: Confirm that the Following Documents have been Developed, Reviewed, and Approved by Appropriate Parties. Confirm Support Activities have been Completed and Documented			
1. Work Instructions Detailing Sequence of Work			
a. Supporting Drawings and Specifications			
b. Inspection Hold Points			
c. Data Forms			
d. Job Hazards Analysis (JHA) of Each Work Step in Instructions			
2. Environmental Release and Discharge Permits			
a. SPDES			
b. NESHAPS			
3. Work Permits			
a. Radiation Work Permits (with current rad surveys)			
b. Hazardous Work Permits			
c. Confined Space Entry Permits			
d. Cutting, Burning, and Welding Permits			
e. Excavation and Trenching Permits			
f. Scaffolding Permits			

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
g. Lifting and Rigging Permits			
h. Special Equipment Operating Permits			
4. Material Safety Data Sheets for all Hazardous Materials to be Used			
V. Facility Preparation: Confirm the Existence and Adequacy of Facility Support Features (Inspect)			
1. Space Requirements			
a. Office Space			
b. Rest Rooms			
c. Change Rooms			
d. "Break" Facilities			
e. Material Laydown and Storage Space			
f. Packaged Waste Storage			
g. Flammable Material Storage			
h. Hazardous Chemical Storage			
I. Equipment Maintenance and Storage			
2. Postings			
a. Warning Signs per DOE and OSHA Requirements (e.g. restricted area, rad control area, high voltage, etc.)			
b. Evacuation Routes			
c. "No Smoking" Signs			
3. Custodial Service (Cleaning, Janitorial): Possible S/C			
4. Support Utilities			
a. HVAC Test Complete and Results Documented			
b. HEPA Filter DOP Test Complete and Results Documented			
c. Installed Lightening			
d. Noise Control and Abatement			
e. Physical Barriers to Separate Project Work from Other Operations			

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
f. Utility Air			
g. Electrical Power			
h. Potable Water			
I. Fire Water			
j. Sewer			
k. Disposal System for Radioactive Contaminated Fluids			
5. Systems and Components to be Removed are Tagged or Identified			
6. Lock and Tag Requirements are Completed and Documented in Accordance with Approved Procedures			
7. Breathing Air System			
a. Adequate Volume			
b. Equipment Tested			
c. Air Certified			
VI. Support Facilities			
1. Waste Processing			
2. Waste Packaging			
3. Decontamination (equipment and/or personnel)			
4. Medical			
VII. Support Equipment Preparation: Verify the Readiness of Support Equipment (e.g., Inspections, Maintenance, Testing Logs/Documentation Completed)			
1. Heavy Equipment (test, inspection, and certification)			
a. Trucks			
b. Cranes			
c. Bulldozers			
d. Back Hoes			
e. Fork Lifts			
f. Front End Loaders			

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
2. Waste Solidification Systems			
3. Volume Reduction Equipment			
a. Shredders			
b. Compactors			
4. Decontamination Equipment			
a. High Pressure Liquid			
b. Liquid Abrasive			
c. Dry Abrasive			
d. Scabbling, Grinding, Chipping			
e. Chemical Decontamination Equipment (system)			
5. Hand and Power Tools (inspect and test)			
a. Proper Guards			
b. Proper Grounding			
6. Lifting & Rigging (tested and certified)			
a. Wire Rope			
b. Slings (including rope)			
c. Come-Alongs (including block and tackle Assemblies)			
d. Shackles			
e. Hooks			
7. Preventive Maintenance Program in Place			
VIII. Traffic Control			
1. Loading/Unloading and Staging Zones Designated and Posted			
2. Traffic Flow Patterns Established and Marked			
a. Equipment			
b. Personnel			
3. Roadways, Gates, Doors, Hallways, Corridors, etc. Evaluated for Heavy or Oversized Equipment/Material Movement			

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
4. Hazardous Material Transport Routing Established			
a. Onsite			
b. Offsite			
5. Waste Disposal Routing Established (offsite)			
a. Routing Capable of Supporting Loads			
b. Local Officials (Communities) Along the Route are Involved			
c. Permits Obtained			
d. Transport Routing, System Upgrades, and/or Modifications Completed and Approved.			
6. Onsite Escort Requirements Available (e.g., security, radiation control, etc.)			
7. Approved Waste Packages for Radioactive and/or Hazardous Materials Available			
a. Properly Specified			
b. Proper and Approved Labeling			
IX. Industrial Safety and Hygiene: Ensure the Availability of Adequate Quantities and the Functional Adequacy of Worker Protective Equipment and Materials			
1. Personnel Protective Equipment (PPE)			
a. Hard Hats or Other Head Covering			
b. Safety Glasses/Goggles			
c. Gloves (specific to tasks)			
d. Safety Shoes			
e. Hearing Protection			
f. Special PPE for Hazardous Material Handling			
g. Respirators			
h. Heat Stress Protection (air suits, ice vests, etc.)			
I. Lifting Supports			
j. Fall Protection Devices			

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
2. First-Aid Kits			
3. Herbicide/Pesticide Spray			
4. Air Monitors (with alarms)			
a. Explosive Gas			
b. Hazardous Chemicals			
c. Asbestos (samplers)			
X. Radiation: Ensure Availability of Adequate Quantities and the Functional Adequacy of Worker Protective Equipment and Materials			
1. Personnel Protective Equipment			
a. PPE			
b. Respirators			
c. Breathing Air Support			
2. Portable Radiation Detectors			
3. Decontamination Supplies			
4. Fixed/Stationary Monitoring Equipment			
a. High-Volume Air Samplers			
b. Constant Air Monitors (CAM) with Alarms			
c. Area Radiation Monitors (ARM)			
d. Sample Counting Systems			
e. Personnel and Equipment Frisking Stations			
f. Portal Monitors			
5. If Fissionable Material is Present, Criticality Detection and Alarm System are In Place, Tested, and Results Documented			
6. Contamination Controls In Place			
a. Containments			
b. Tents			
c. Barriers			
d. Step-Off Pads			

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
e. Laundry Hampers			
f. Proper Postings			
g. Fixatives			
7. Temporary Shielding In Place			
XI. Environmental Protection			
1. Environmental Surveillance Program - Required Documents are In Place with Proper Approvals			
2. Effluent Control (filtration, water treatment, etc.)			
a. All Potential Effluent Discharges Identified			
b. Control System(s) Adequate for Effluent Contaminant Control			
c. Control System Installed and Tested with Results Documented			
3. Effluent Monitoring			
a. All Potential Effluent Discharge Points Identified			
b. Effluent Monitors Installed and Tested With Results Documented			
c. Sample Locations Located and Sample Systems Installed and Functionally Verified			
XII. Emergency Preparedness: Confirm the Availability and Functioning of the Emergency Preparedness System			
1. Communications			
a. Two-way Radios			
b. Pagers			
c. Telephones			
d. Public Address (PA) System			
e. Alarms (fire, radiation, chemical, criticality)			
2. Fire Equipment - In Place, Functional, and Properly Labeled			
a. Sprinkler System			
b. Pull Boxes			

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
c. Fire/Smoke Detectors			
d. Fire Extinguishers			
e. Hydrants			
f. Stand Pipes			
3. Fire Exits Clearly Marked and Unobstructed			
4. Unique Fire Suppression Material (e.g., halon, sand, foam, etc.)			
5. Safety Showers, Eye Wash, Decontamination Facilities In Place and Functional			
6. Emergency Breathing Air Supply (e.g., SCBA)			
7. Emergency Supply Cabinet Fully Equipped and Readily Accessible			
8. Emergency Lighting Available and Operable			
9. Emergency Power or UPS Available and Operable			
XIII. Worker Training, Testing and Qualification: Verify That Each Worker Has Completed the Following, Been Successfully Tested When Required, and a Record is Available Verifying the Worker Qualification			
1. Basic Training Complete - All Workers			
a. HAZWOPER			
b. RAD WORKER			
2. Supervisor Advanced Training			
a. RWT Supervisor			
b. HAZWOPER Supervisor			
3. Specialized Worker Training			
a. Heavy Equipment Operator			
b. Welder			
c. Health Physics Technician (RAD-CON)			
d. Special D&D Equipment Operator			
e. RAD Waste Operations			

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
f. Waste Process Equipment Operator			
g. Plutonium Handling			
4. Site Specific Hazards Indoctrination			
5. Emergency Response Drills Conducted and Documented			
6. Medical Examination (fitness requirements)			
7. Respirator and Breathing Air Testing and Qualification			
8. Special PPE Training and Qualification			
9. "Dry-Run" or Demonstration Successfully Conducted and Documented for Any New Technology or Equipment to be Utilized			
10. Mockup Training is Completed and Documented			
11. Work Package Indoctrination with the Workers and Walkdowns are Completed			
XIV. Subcontractors: Ensure that All Subcontractors are Mobilized as Required and All Pre-Job and Mobilization Requirements are Complete			
1. Pre-Job Deliverables are Received and Accepted by the Project			
a. Health and Safety Program and Plans			
b. QA Plan/Program			
c. Worker Certifications (i.e., training, medical, special equipment operator, resume, etc.)			
d. Equipment Certifications			
e. Special Operating Procedures			
2. Subcontractor Resources			
a. All Required Subcontract Personnel are Onsite and have Successfully Completed Site-Specific Qualification Requirements			
b. All Required Subcontractor Equipment is Onsite and has been Successfully Tested			
c. All Required Support Materials and Consumables are Staged Onsite and Available			

READINESS CHECKLIST

PROJECT: _____ PROJECT MGR:_____

	ACTION ASSIGNEE	ACCEPTABLE?	
		Yes	No
XV. Management of Change: Ensure that a Change Control System is In Place and Workers are Familiar with the Requirements			
1. Pre-Job Meetings to Discuss Anticipated Hazards and Hazards Controls (daily)			
2. Lessons Learned from Work Completed			
3. Response to Unanticipated Conditions of Workplace			