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DOE STANDARD

WRITER'S GUIDE FOR TECHNICAL PROCEDURES

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

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Writer's Guide for Technical Procedures

Page / Section	**Change**
p. 1 / Introduction / third paragraph	The reference to DOE Order 5480.5, *Safety of Nuclear Facilities*, was removed.
p. 58 / Development References	The reference to DOE Order 5480.5, *Safety of Nuclear Facilities*, was removed.
p. 58 / Development References	The reference to NUREG/CR-1369, *Procedures Evaluation Checklist for Maintenance, Test, and Calibration Procedures,* was updated to NUREG-CR-1369-Rev.1.
p. 58 / Development References	The reference to NUREG/CR-2005, *Checklist for Evaluating Emergency Operating Procedures Used in Nuclear Power Plants,* was updated to NUREG/CR-2005-Rev.1.
p. 58 / Development References	The volume number and volume title to reference NUREG/CR-3177, *Methods for Review and Evaluation of Emergency Procedures Guidelines,* were added.
p. C-4	The definition for "task" was updated.
p. C-4	The definition for "task analysis" was updated.
p. C-5	The definition for "technical safety requirements (TSR)" was updated.
Concluding Material	The Preparing Activity was changed from EG&G, ID to EH-31.

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Revision Log

Revision Number	Date Approved	Pages Affected	Description of Revision
0	December 1992	All	Initial Issue
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Foreword

This *Writer's Guide for Technical Procedures* replaces Revision 0 of DOE/NE SP-0001T, DOE Standard (For Trial Use), *Writer's Guide for Technical Procedures*, issued in September 1991. The substantive changes between Revision 0 and this document involve format and language.

This document has been formatted as a handbook rather than as a procedure. That is, the way in which this writer's guide is formatted is no longer intended to be an example of procedure formatting (as Revision 0 was). Examples are now set off more clearly from the text, lettered lists have been replaced by bulleted lists, and more font sizes and styles have been used for separation and delineation.

Editorial changes were made to clarify and simplify the language used to present the guidance in this document. Also changed were some minor corrections and consistency issues identified during the review and comment period on Revision 0. Finally, a sample procedure is included (as Appendix B) in this document to assist users in implementing the guidance into their procedures.

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Preface

This ***Writer's Guide for Technical Procedures*** is one of a series of documents currently being developed by the U.S. Department of Energy (DOE) to define broad requirements for procedure program management and to provide guidance for the preparation of procedures used at DOE facilities. This preface describes the intent and overall approach of the DOE's procedures program and presents a brief overview of how this writer's guide fits into the series of procedures guidance documents currently under development.

Background: The Role of Procedures in Managing Facility Operations

A primary objective throughout the DOE complex is that operations be conducted in a safe, deliberate, and controlled manner. In addition to training or day-to-day supervision, providing sound procedures and requiring workers to use them are among the most formal, direct, and effective methods available to facility managers to ensure that their operations meet DOE's objective. Procedures provide managers with a critical management tool to communicate detailed expectations for how individual workers are to perform specific tasks.

To be effective management tools, however, the procedures that workers use must present the best knowledge available of how to integrate the policies, principles, rules, parameters, processes, controls, products, culture, physical facilities, equipment, material, and people necessary to operate a facility safely. In addition, procedures must be technically and operationally accurate, up-to-date, and easy to follow, or workers will lack confidence in them and may not use them. Ensuring that facility procedures meet these criteria is a complex job.

The best knowledge to be incorporated in procedures must be available to procedure writers in the form of basis documentation. At the most general level, senior management basis documents define the facility's senior managers' goals and expectations regarding the conduct of operations at the facility. Senior management basis documents provide the overall framework, in the form of policies and charters, within which facility operations occur. Policies specify the senior managers' commitment to meeting the company's contractual and regulatory obligations, and define their philosophy of operation. Because they are intended to apply broadly to all site activities, policies generally do not specify the details or mechanics of accomplishing the work. Charters establish an organizational structure and define roles, responsibilities, and authorities for accomplishing the work of the company's contract with DOE. Flowing down from the directions and requirements established by the senior management documentation, three types of lower-level basis documentation are required for procedure development:

Background: The Role of Procedures in Managing Facility Operations (continued)

- The technical programs basis documents define the particular safety aspects and safety implications of the facility's processes. Various hazards analyses and the outcomes of probabilistic risk assessments are first synthesized in a primary safety document—the Safety Analysis Report (SAR)—which details the technical and administrative elements of the operation and defines safety requirements, risks, and postulated accidents. The safety parameters reflected in the SAR are then translated into Technical Safety Requirements (TSRs) that describe the specific operating limits necessary to provide a reasonable safety margin for operations. Additional documents are used to maintain the efficacy and currency of the SAR: Test Authorizations provide direction for temporary modifications, such as when conducting brief experimental runs to test process adjustments. Unreviewed Safety Questions assess the implications of any modification in the design, equipment, or operating ranges of the system to ensure that the modifications do not change the magnitude or type of safety issues the SAR originally considered.

- The management control programs basis documents define all of the management programs and controls needed to support and maintain the operation. These documents define the programs that will accomplish the facility's mission. They address the facility's administrative programs (e.g., quality assurance, document and records management, property management); the operational programs (e.g., corrective and preventative maintenance requirements); technical support operations (e.g., facility safety, radiological controls); and facility design and engineering controls (e.g., configuration management). This collection of documents may also include certain additional management baseline information, such as an annual operating plan, the operational budget, and integrated schedules for accomplishing the work scope.

- The design programs basis documents include the design criteria; calculations and analyses (e.g., seismic calculations) that represent the engineering and construction criteria used; the vendor materials that demonstrate the quality and suitability of equipment; and the engineering standards, drawings, and specifications that were used in the actual procurement, construction, testing, and turnover phases of the facility's lifecycle.

These management and programmatic bases documents, if available, provide much of the information to be used in developing a facility's procedures. However, in many DOE facilities, basis documentation is out-of-date, incomplete, or has not yet been developed. In some facilities, procedure writers are being set the impossible task of preparing sound procedures without basis documentation or are required to develop it themselves before they begin writing procedures.

Background: The Role of Procedures in Managing Facility Operations (continued)

Even in facilities where the bases documents are accurate and available, this information must be organized and applied appropriately in developing a procedure for a specific process (a recurring work activity with a measurable product). Further, the resulting procedure must be accurate and easy to follow. Meeting these objectives requires the implementation of procedures programs that include, among others, the following program elements:

- The cooperation of management, technical, and administrative personnel in ensuring that sufficient staff time, information, and other resources are available to those individuals responsible for the procedures program.

- Properly trained procedure writers, reviewers, and users.

- Writer's guides for defining the format and writing styles to be used to ensure that procedures are easy to follow.

- Formal processes for verifying and validating the procedures before use to ensure that they are accurate and easy to follow.

Further, procedures must be updated as required by operational activities: upgrades or modifications to equipment or systems may trigger procedural changes; adjustments in training requirements or certification levels may require reassessment of procedures; and changes in the safety requirements or management philosophy may also result in review of procedures to ensure that the procedures reflect the current configurations, philosophy, and safety criteria. Additionally, procedure revisions also result from growing operational sophistication: continued use of a procedure or the system or equipment it addresses may identify a better or more appropriate method for completing the task. Any change to the bases for facility operations will be likely to require procedure revisions.

Establishing and managing an on-going procedures program requires the active participation of personnel at all levels in the facility:

- The Facility/General Manager's responsibility is to have a disciplined procedure system integrated with and supported by the overall management control system.

- The Operations/Technical Manager's responsibility is to have procedures to address the facility's complete scope of work.

Background: The Role of Procedures in Managing Facility Operations (continued)

- The Technical Reviewer's responsibility is to ensure that procedures reflect the true and complete scope of the applicable technical, management control, and design bases the procedure is designed to implement.

- The Procedure Manager's responsibility is to have a controlled production system that ensures procedures are correct, usable, and available when needed.

- The Procedure Writer's responsibility is to develop procedures that provide specific instructions for task performance and to use the facility's writer's guide to present those instructions in an easy-to-follow manner.

- The Operating Staff's responsibility is to use procedures appropriately and to understand their significance in maintaining a disciplined, safe operation.

The development and on-going management of sound procedures, then, rests upon the availability of a large array of different types of information and the integrated efforts of facility personnel. If the basis information has not been documented, is inaccurate, incomplete, or otherwise unavailable to the procedure writer, or if facility personnel do not actively support the procedure program, procedures will be inaccurate, incomplete or so hard to follow that workers will avoid using them. If procedures are inaccurate, incomplete, or not used, they cannot fulfill their primary function of assuring that work processes are occurring in a safe, deliberate, and controlled manner.

Procedures and the Safety Envelope

The overall safe operation of the facility depends upon the structured interrelationship among DOE requirements and guidance, the bases documentation (senior management, technical, management control, and design), and the facility's procedures—generally referred to as its safety envelope. In other words, a facility's procedures define how requirements, management philosophies and strategies, and technical knowledge will be integrated and applied to performing work in the facility. Figure 1 illustrates a facility's safety envelope, and shows how requirements, guidance, and technical and managerial constraints flow down through a facility's basis documentation and are incorporated in the facility's operations.

Procedures and the Safety Envelope (continued)

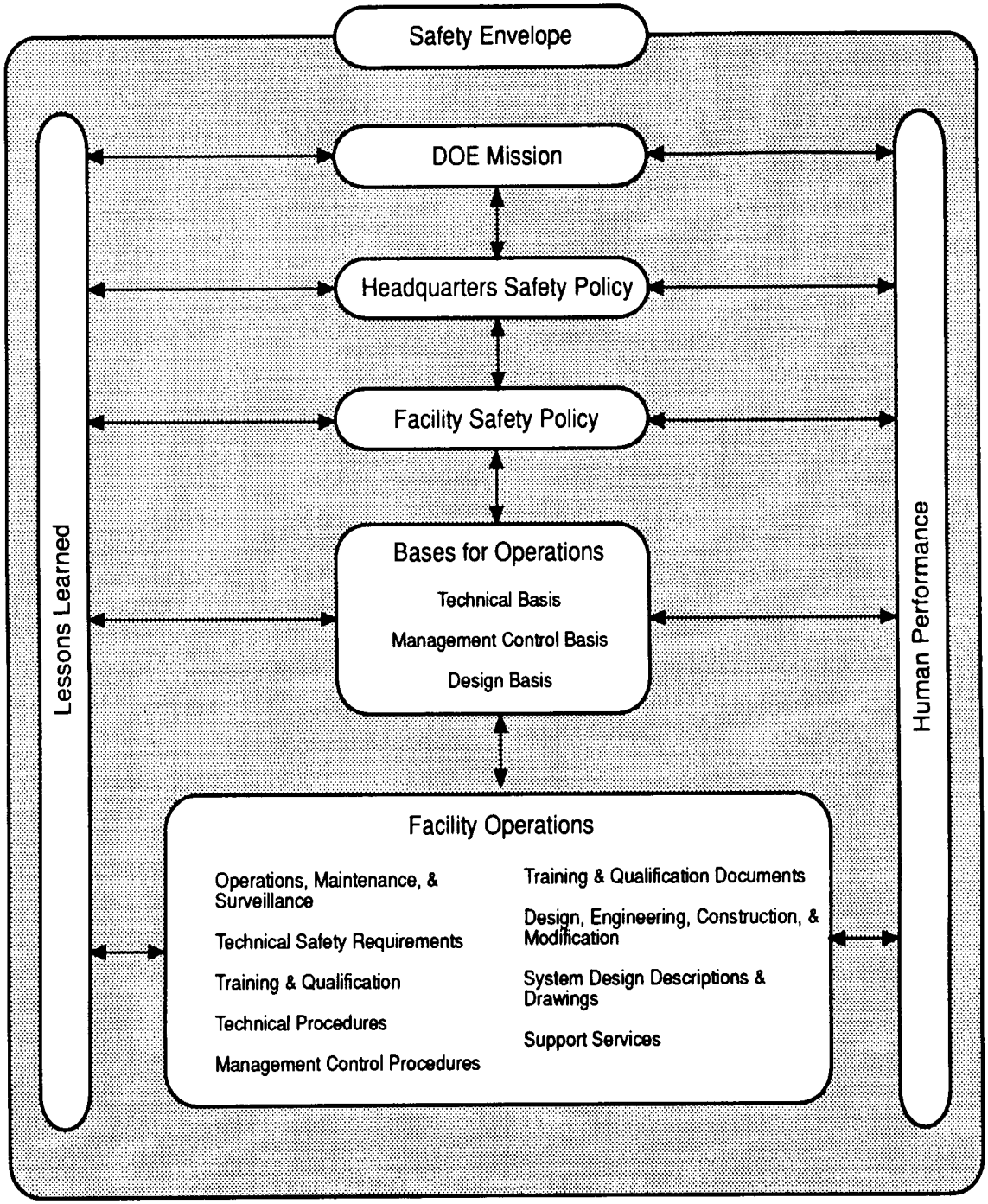

Figure 1: Safety Envelope Diagram

Types of Procedures

Because procedures must address how all operations and processes are to be performed, from the administrative to the technical, several types of procedures must be part of a facility's safety envelope:

- Management control procedures define the communication and coordination activities necessary to carry out the facility's technical programs, management control programs, and design control programs. These procedures describe the processes to be followed to ensure that all of the various programs' functions are effectively integrated and that the programs' requirements are applied appropriately throughout the facility's lifetime.

- Technical procedures prescribe precisely how to accomplish the various technical tasks associated with starting up, testing, operating, and maintaining the facility's equipment and systems. These procedures specify fixed tasks and define activities in a way that ensures operations are safe, efficient, and practiced within the appropriate margins of safety.

- Emergency and alarm response procedures define the action steps to take when an abnormal condition exists. Emergency procedures address conditions that require immediate and absolute attention to mitigate problems, reestablish safety boundaries, and bring operations and equipment back within established operating parameters. Alarm response procedures address the actions to be performed in response to annunciators and other types of facility displays that indicate an off-normal condition.

Each of these procedure types is slightly different owing to the intended purpose and use of the procedures; the considerations in effect at the time of use; the level of detail required to allow the task to be accomplished; the typical user of the procedure; and the degree to which compliance with the procedure must be documented.

The DOE Procedures Program

Because the development of sound procedures and on-going procedure management are complex and new activities for some DOE facilities, and because of the key role that procedures play in ensuring safe, deliberate, and controlled operations, the DOE has initiated a program to define requirements for procedure system management and to provide guidance in certain areas that have not previously been addressed in detail within the DOE literature. As part of this program, a series of DOE procedures documents is currently under development. The intent of these documents is to provide a knowledgeable and reasonable approach to all aspects of procedure management that will ensure the availability and use of sound procedures at DOE facilities.

The DOE Procedures Program (continued)

The procedure guidance documents are in various stages of preparation and review. Some, such as this *Writer's Guide for Technical Procedures*, are already available to DOE personnel as a standard. Documents currently under development include:

- Principles for Excellence in Procedure Writing: This document presents the fundamental principles associated with writing sound procedures. The principles provide a basis for understanding how to develop and evaluate procedure formats and writing style. Therefore, the Principles serve as a means for each facility to confirm the adequacy and appropriateness of the writer's guides developed for the facility's procedure writers.

- Writer's Guides: Three separate writer's guides are being developed, one for each of the three major procedure types: technical procedures, emergency and alarm response procedures, and management control procedures. An appendix to the *Writer's Guide for Technical Procedures* and the *Writer's Guide Emergency and Alarm Response Procedures* will cover the use of graphics in procedures. The guides are model writer's guides, rather than requirements documents, and provide examples of writer's guides that meet DOE requirements. Each of the guides provides a basic explanation of the technical, management control, and design bases for that procedure type, and then provides detailed sections on content and format.

- Principles for Excellence in Procedures Programs: This document presents the fundamental principles associated with managing an on-going procedures program. It defines the purposes procedures serve in facility operations as well as the program elements and processes required for an effective procedures program.

- Manager's Guides: Four separate manager's guides are being developed. The Guides will cover four important functions: developing procedure bases; technical review of procedures; validation and verification of procedures; and, procedure implementation and control. The Guides will provide managers with explanations of the requirements and processes associated with successful completion of these functions.

As is shown in Figure 2, the above documents provide for both product enhancement (better procedures) and system enhancement (better procedures programs). As experience in applying these documents is gained throughout the DOE complex, the documents will be revised on the basis of lessons learned. Additional guidance documents also may be published as the need arises.

The DOE Procedures Program (continued)

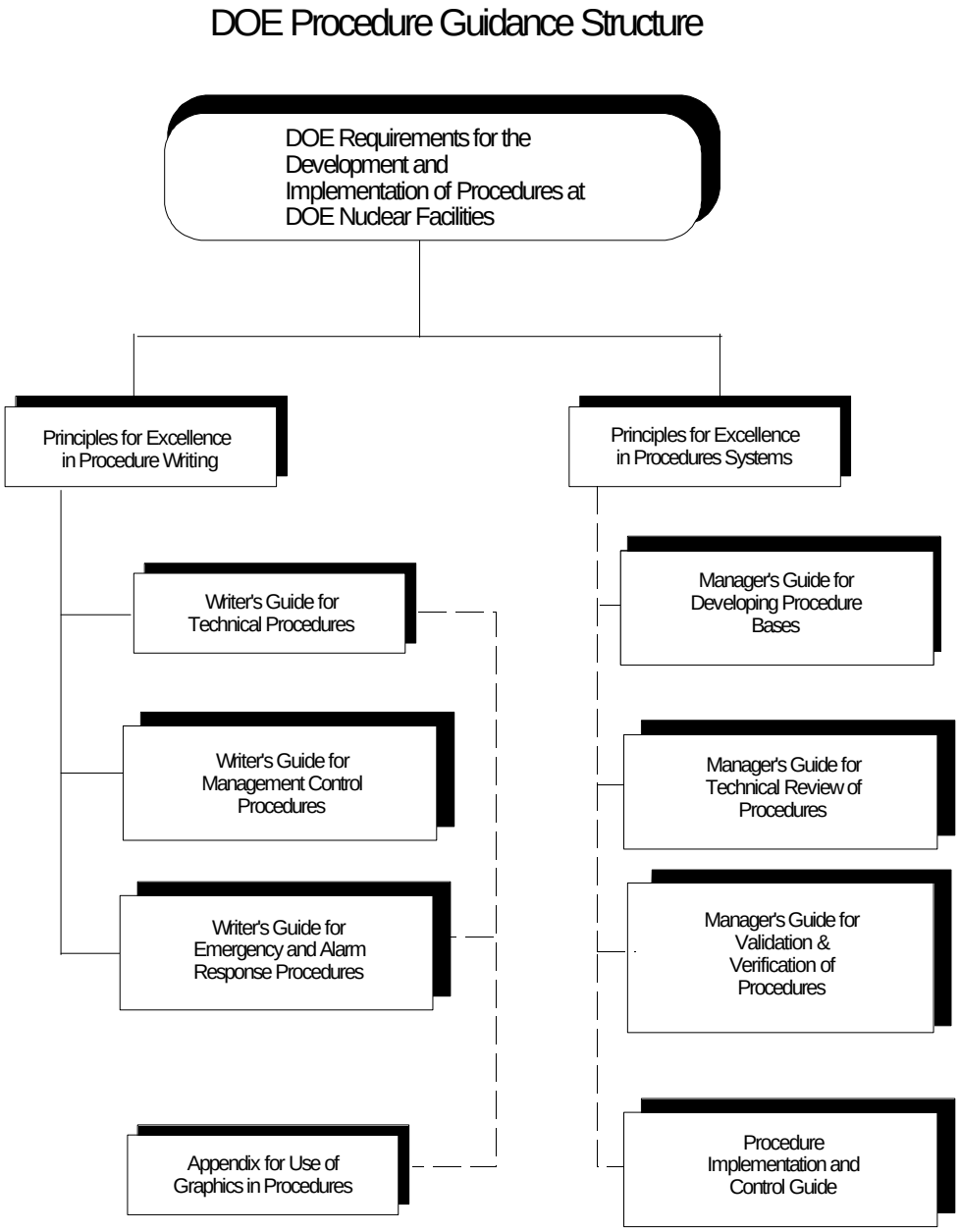

Figure 2: Proposed Documents for DOE Procedure Guidance

1 INTRODUCTION

A primary objective of operations conducted in the U.S. Department of Energy (DOE) complex is safety. Procedures are a critical element of maintaining a safety envelope to ensure safe facility operation.

This DOE *Writer's Guide for Technical Procedures* addresses the content, format, and style of technical procedures that prescribe production, operation of equipment and facilities, and maintenance activities. The DOE *Writer's Guide for Management Control Procedures* and DOE *Writer's Guide for Emergency and Alarm Response Procedures* are being developed to assist writers in developing nontechnical procedures.

DOE is providing this guide to assist writers across the DOE complex in producing accurate, complete, and usable procedures that promote safe and efficient operations that comply with DOE orders, including DOE Order 5480.19, *Conduct of Operations for DOE Facilities*, and 5480.6, *Safety of Department of Energy-Owned Nuclear Reactors*.

Successful procedures assist users by presenting actions clearly, concisely, and in the proper sequence. This guide provides a method for writers to ensure the following key questions are addressed and that procedures contribute to maintaining safe operations:

- What technical and administrative requirements are to be met?
- Who is the user and what is the user's level of experience and training?
- How does this document relate to other procedures for this equipment and facility?
- What materials, equipment, and facilities are to be used?
- What tasks are to be accomplished?
- Why, when, where, and how are the tasks to be accomplished?

1.1 Organization of this Guide

This guide for writing technical procedures is presented in five sections:

- Section 1 provides an introduction to the writer's guide and the process involved in writing technical procedures
- Section 2 presents information about establishing the procedure basis for the procedure content
- Section 3 discusses procedure content and format
- Section 4 deals with writing and structuring action steps
- Section 5 cites references used to develop this guide.

Appendixes provide additional information in worksheets, a glossary, a list of acronyms and abbreviations, and a verb list.

1.2 Purpose of this Guide

This writer's guide establishes the recommended process for developing technical procedures that are accurate, complete, clear and consistent. It provides guidance for

- Developing a procedure basis
- Planning, organizing, and structuring
- Developing content and establishing format
- Writing action steps.

The examples in this guide cannot cover every situation. The guidance presented should be applied as appropriate when writing procedures.

1.3 Scope of this Guide

This guide assists writers, reviewers, administrators, subject matter experts, support personnel, and users involved in developing and writing technical procedures that assist production, operation of equipment and facilities, and maintenance activities. Technical procedures include:

- Normal operating procedures (NOPs)
- Planned nonroutine operations procedures (off-normal operating)
- Surveillance and test procedures
- Maintenance procedures
- Analytical procedures.

Until the writer's guides for management control procedures and emergency and alarm response procedures are issued, selectively apply the techniques presented in this guide to those procedure types.

1.4 Involvement of Operational Organizations in Procedure Development

Procedures are written for facility operational personnel; therefore, operators are an important source of information when developing procedures. Personnel from the operational organization should be involved in the process from the initial decision to write a procedure through the review, verification, and validation of the procedure.

Facility operators can provide valuable insight into the job being performed, information about past operating experience, and data for developing the procedure basis of the procedure. Their involvement in the process can include participating in walkthroughs

and walkdowns and identifying behavioral obstacles, cautions, and valuable nonstandard source documentation beyond safety analysis reports (SARs), probabilistic risk assessments (PRAs), technical safety requirements (TSRs), vendor manuals, and old procedures.

2 ESTABLISHING THE BASES FOR PROCEDURES

Because procedures are a critical element of maintaining a safety envelope, they must be based on the same facility design bases, design verification and functional test results, safety analyses, and operating limits and surveillance requirements used to establish the safety envelope. There are at least three pertinent bases to consider for the development of the technical procedure, the management control basis, technical basis, and design basis.

The technical basis of a technical procedure is a compilation of information such as the Safety Analysis Report, Technical Safety Requirements, operational "lessons learned", facility configuration, and conditions of performance. The technical basis documentation is needed to describe the technical parameters and boundaries within which the process is performed.

The management control basis of a technical procedure contains information such as management controls on the process, facility administrative requirements, and relevant management plans and programs.

The design basis of a technical procedure includes the design criteria, vendors, and engineering standards drawings and specifications that were used in the design and construction of the facility.

The process of establishing the bases involves activities used to research and plan the content of a procedure. The bases of a procedure must be defined before the actual writing can begin. The procedure writer develops procedure bases by either updating the bases of a current procedure or creating bases for a new procedure. The bases provide a researched compilation and analysis of the engineering and design, safety, operations, regulatory, vendor, and administrative information necessary to develop a comprehensive and usable procedure. They are based on the facility as-built drawings, lessons learned, test information, administrative and management controls, and other relevant information.

The bases are working documents and are part of the Procedure History File (PHF). The PHF is compilation of all pertinent information used to develop the procedure and any subsequent revisions. The bases are used to analyze the requirements that must be included in a procedure or revision. The contents of the bases may be revised during procedure preparation to ensure that the final product contains accurate and relevant information.

All the bases combined are referred to as the procedural basis. The procedural basis is used for:

- Writing the procedure
- Simplifying the review process

- Developing later revisions
- Resolving audit findings
- Providing useful fault analysis information.

Follow six basic steps to assemble the procedure basis information: (1) develop a research and planning process; (2) identify the procedure requirements; (3) determine the facility configuration and analyze the process; (4) develop the process and activities; (5) assemble procedure basis documentation; and, (6) prepare a procedure revision history.

2.1 Research and Planning Process

Procedures are written and used for work that could result in abnormal facility conditions, degraded equipment reliability, or personnel or equipment hazards. Procedures are also needed for complex nonsafety-related work, and for work that is performed infrequently.

[1] Identify the procedure to be written.

[2] Plan the research process.

[3] Record the research and planning process to document the basis of the procedure. Be sure to record the methods, calculations, and user feedback obtained during procedure development that might not exist elsewhere.

[4] Identify the appropriate operations organizations and plan for their personnel to help develop the procedure.

As stated in Section 1, operations personnel provide valuable insight when writing a procedure. Operations personnel can greatly improve procedure basis documentation for technical processes, conditions of performance, process analysis, and user feedback.

2.2 Procedure Requirements

Writers must understand the bases for procedures before they begin to write. Completing the following steps will help writers understand these bases (the worksheets in Appendix A can be used to record information).

[1] Research the regulatory and administrative requirements affecting the procedure. This research includes assembling and reviewing documents containing direct requirements and commitments that apply to the procedure.

[2] Determine the technical requirements that apply to the procedure by examining the following:

- DOE rules, orders, and standards.
- Safety analysis report and technical safety requirements (formerly technical specifications or operational safety requirements).

- Approved vendor information.
- Other procedures that describe similar functions, including procedures from outside organizations if necessary.
- Technical literature such as textbooks.
- Engineering documents such as engineering drawings or analysis reports.
- Records of the basis for and development of methods and calculations.
- Analyses of the process.
- User feedback reports.
- Relevant event reports, root cause analyses, and lessons-learned documents.
- Results of design verification, qualification tests, and functional tests.
- Other relevant information that should be reviewed and incorporated into the procedure basis such as letters of commitment and contracts.

[3] Document the information used to determine procedure requirements. This documentation may include a list of procedures used or referred to during the research (the worksheets in Appendix A provide a sample of how information may be documented).

2.3 Facility Configuration

To ensure the technical adequacy and accuracy of process and equipment information in the procedure, perform a detailed check (walkthrough).

[1] Study technical safety requirements, the safety analysis report, or other documents to understand the process. Refer to appropriate drawings before and during walkthroughs.

[2] Perform an appropriate assessment (using walkdowns, simulations, modeling, or desk-top reviews) to note

- Equipment configuration
- Nameplate information
- Environmental or location factors that may influence procedure performance or increase the safety risk to the user, such as radiation or chemical hazards, equipment locations requiring ladders, special lighting, scaffolding, or rigging.

[3] If practical, observe the activity being performed (or a simulation of the performance) and similar activities. Observing an activity can identify activity

sequences and techniques used that might not be apparent by reading the existing procedure.

[4] Research potential hazards and problems in performing the activities.

- Interview procedure users familiar with similar activities.
- Learn about past problems with the existing procedure.
- Obtain suggestions for improving methods from operators and training personnel.
- Review procedure use histories or other documents that record previous performance (for example, maintenance histories for maintenance procedures).

[5] Determine how frequently the procedure is used.

[6] Consider the consequences if the procedure is not performed correctly.

[7] Identify the administrative processes that affect the procedure process. Administrative processes include required verifications, inspections, and notifications. Be specific. For example, “Observe all safety rules” or “refer to the facility's safety manual Section 10” does not add specific work instructions; the procedure user may not do the research required to identify specific instructions.

2.4 Process Analysis

After completing the research and planning process, determining the procedure requirements, and reviewing the facility configuration, perform an analysis of the activities that make up the process. A process analysis identifies the requirements of the activity and the functions that must be accomplished to meet the process objectives. While performing a process analysis, consider the rationale behind the activities, activity frequency and complexity, the consequences of an error, and the relationship of training to successful performance of the activity. The activities are translated into action steps in the performance sections of the procedure. Analyze the process while developing the process and activities of a procedure (see “Develop the Process and Activities” in this section).

[1] Determine the following as applicable:

- The principal users of the procedure and other participants in the process, including support functions such as health physics and laboratory services
- The level of detail to be used in writing the procedure based on user training and qualifications (see “Appropriate Level of Detail” in Section 3).

[2] Review available process information such as task analyses.

[3] Review a similar procedure to help establish the appropriate level of detail.

An important part of the process analysis is to identify where extra caution is needed. The analysis identifies and helps mitigate the potential for abnormal events by writing procedures sensitive to aspects of the process that could cause errors. The analysis identifies design defects and assists procedure developers in providing warnings and cautions at appropriate places within the procedure to help the procedure user to recognize and prevent mishaps or mitigate the effects if mishaps occur. The analysis should be documented as part of the procedure basis.

2.5 Develop the Process and Activities

A procedure provides a process (method) to accomplish a specific task. Use information gathered in the process analysis to define the process, define the activities that make up the process, and organize the activities into related sections. These sections will become the subsections and action steps within the procedure.

[1] Identify each activity within each process.

[a] Assess the technical requirements to accomplish the activity, such as

- System/component configuration
- Interfaces with other procedures and with other organizations
- Limitations
- Potential hazards and problems
- Expected system responses.

[b] Assess applicable administrative requirements such as verifications, inspections, and notifications (a form such as the Administrative Requirements Worksheet shown in Appendix A can may be used to record the requirements for each activity).

[2] Place the activities identified in sequence in their order of performance. Outlines, tables, and flow charts are useful for viewing the sequence and hierarchy of the activities required to complete the process.

[3] Review the activities and combine common activities. Activities can be combined as long as they do not increase the complexity of the procedure or interrupt the correct sequence of actions.

[4] Develop a clear, concise statement of purpose for performing the procedure.

[5] List other documents, forms, and definitions of important terms that will be used to support the procedure being developed.

[6] Develop procedure headings as applicable (see Section 3, “Procedure Organization” and “Headings”).

[7] Identify the portions of the process to be addressed in each of the following procedure sections:

- Prerequisite actions
- Performance sections
- Post-performance activity.

[8] Include activities that respond to limitations and potentially hazardous conditions. These activities were identified in the process analysis.

2.6 Assemble the Results of the Research into the Procedure Basis

Procedure basis documentation for a procedure documents all research results from activities previously discussed.

[1] Assemble the research documents in a logical manner that is easy for reviewers and procedure writers to access. Documentation may include appropriate listings of documents, copies of resource material, data sheets, checklists or worksheets (example worksheets are provided in Appendix A).

[2] Attach records of the research that were not included on the worksheets that support the procedure basis, such as observations, literature searches, methods development, and calculations.

[3] Complete the procedure basis documentation by placing purpose and scope statements in front of the worksheets and other information.

EXAMPLE 2-1. Overview statement for a procedure basis.

1.1 Purpose

This collection of information provides the procedure basis for SP-EG-1-K, GM Diesel Generator No Load Test.

1.2 Scope

This procedure basis includes documentation of the research used to evaluate the conditions and constraints relevant to performing SP-EG-1-K, GM Diesel Generator No Load Test.

2.7 Prepare a Revision History

The revision history provides a history of the procedure and specifies its effective date. Although the revision history may be initiated at this point in developing a procedure, it cannot be completed until the procedure is approved.

[1] Include the following information in the revision history:

- Revision level
- Effective date
- Affected pages
- Revision description.

EXAMPLE 2-2. Revision description.

Revision 2 was done to reflect the equipment changes made to the chilled water supply system.

---

[2] Provide a specific statement of the reason for the revision. Generalizations, such as general revision, do not provide meaningful information.

[3] List the procedure(s) that the new procedure replaces or requirements that the procedure implements.

[4] If the number of the procedure changes, cite the old number in the revision history to provide appropriate history and cross referencing.

[5] Add the approval date to the description of the revision for use in tracking periodic reviews.

[6] Include any temporary changes implemented since the last revision.

[7] Maintain and update the procedure basis documentation to ensure that a complete history of the procedure is available each time the procedure is revised.

3 CONTENT AND FORMAT

3.1 General Content and Format Guidelines

This section discusses the technical subject matter content and organization of a procedure. It also defines the format of procedure pages, headers, and other elements.

All types of procedures are not within the scope of this writer's guide. While sections within this writer's guide may apply to other than technical procedures, writers should exercise discretion when applying the guidance presented. For help with procedures exclusively formatted with graphics, or those portions of procedures which combine graphics and text, the *DOE Guide for Use of Graphics in Procedures* will, when completed, be attached as an appendix to this document.

3.1.1 Appropriate Level of Detail

Writing at the appropriate level of detail is the key to successful communication with procedure users. For ease of use and to reduce distraction and confusion, only include information in the procedure that relates directly to completing the task.

[1] Write procedures to a level of detail consistent with the qualifications and training of the expected users. Job task analyses and training records provide information useful in assessing the level of detail requirements. When in doubt, write to the lowest common denominator.

[2] Provide a level of detail that takes into account the following variables:

- Qualification level of the user. As qualification level increases, level of detail can decrease on tasks that are simple or are frequently performed.

- Complexity of the task. As task complexity increases, level of detail can increase.

- Frequency of task performance. As task frequency increases, the level of detail can decrease.

- Degree of standardization desired. Level of detail varies directly with the degree of standardization desired. The more standardized the performance, the more detailed the procedure.

[3] Determine whether the amount and kind of information provided are adequate for intended users by answering the following questions:

- Can the procedure be performed in the sequence it is written?

- Can the user locate and identify all equipment referred to in the procedure?

- Can the user explain in detail how to perform general instructions?

- Can the user perform the procedure without obtaining additional information from persons or procedures not specified by the procedure?

- Can the user perform the procedure without obtaining direct assistance from persons not specified by the procedure?

[4] Ensure that the decision making required in the procedure is consistent with the user's qualifications and level of authority. This approach permits tasks to be performed with minimum supervision.

[5] Exclude information that is useful only to reviewers or other persons not involved in performing the procedure.

3.1.2 Consistency

One of the most important principles in writing effective technical procedures is to maintain consistency in procedure style, format, and organization, both within and among procedures. Inconsistencies can result in users attributing differences in meaning to spurious differences in presentation. Consistency allows users to move through documents without having to waste effort interpreting the style of presentation for each section they encounter. This facilitates comprehension and allows users to concentrate on the actual performance of the instructions. When employing the guidelines discussed in this document, maintain consistency!

3.1.3 Writing Style and Language

Narrative prose and paragraph style are inappropriate for writing procedures. Users of procedures will likely be working under difficult, sometimes very stressful conditions, and thus procedures should be written so that users can grasp the intended meaning quickly and easily.

[1] Communicate instructions using simple and concise language, although not at the expense of comprehensibility.

[2] Use action statements to communicate procedure instructions to users.

[3] Maintain consistency in language (words, definitions) and format among instrument labelling, procedures, and training.

[4] Avoid using synonymous terminology merely for the sake of introducing variation. Use words and phrases consistently throughout procedures.

[5] Write instructions clearly. The users should not have to infer the meaning.

[6] Select vocabulary carefully. Use simple, common vocabulary that accurately reflects intended meaning and which is common and familiar in the context of the training users receive. Use technical terms when they are the most common and familiar terms to the users.

[7] Adhere to grammatical conventions and to the punctuation rules of standard American English.

[8] Rewrite sentences, if necessary, to avoid excessive punctuation.

[9] Avoid ambiguous words, e.g., "the right valve" should be rephrased as "the right-hand valve" and augmented by the specific valve name or number.

[10] Avoid vague adjectives (words modifying nouns) and adverbs (words modifying verbs) which are subject to interpretation. Specify quantities whenever possible (e.g., "Drain the tank at 10 gallons/minute" is preferable to "Drain the tank slowly.").

[11] Limit the use of abbreviations and acronyms.

[12] Develop a restrictive list of abbreviations and acronyms and use only those words on this list. Users should be familiar with these acronyms and abbreviations without having to refer to the list.

[13] Ensure that each abbreviation and acronym is uniquely associated with a single specific term. Do not use the same abbreviation or acronym for two different meanings.

[14] Avoid using abbreviations ending in a period so as not to suggest the end of the sentence.

3.1.4 Numerical Information

[1] Maintain consistency in using Arabic numbers (e.g., 0, 1, 2) and spelled-out numbers (e.g., zero, one, two).

[2] Use spelled-out numbers when one number without a specified unit of measure is followed directly by one with a unit of measure.

EXAMPLE 3-1. - Use of spelled-out numbers with a unit of measure.

Use: "Energize one 4.16 kV bus."
Do not use: "Energize 1 4.16 kV bus."

[3] Use spelled-out numbers when a number, typically a single digit number, is emphasized.

EXAMPLE 3-2. - Use of spelled-out numbers with emphasis.

"Use **one** of the following." is preferable to "Use **1** of the following."

[4] Otherwise, use Arabic numbers to present numerical information, as in "Decrease tank level by 10 inches."

3.1.5 Instrumentation/Component Information

[1] Refer to instruments and components using both the equipment name and number. The equipment name can be the verbatim equipment label, a paraphrased equipment label or some other name, depending upon which is the most familiar to users. Ideally, there should only be one name in use for any given piece of equipment. Set the numeric identifier apart from the equipment name (e.g., by placing it in braces after the common usage name as in: "Open both Vessel Vent valves {GH-32-1 and GH-32-2}.").

[2] Do not require users to interpret ambiguous descriptors, such as "approximately" and "slowly" when referring to instrument information.

[3] Specify numbers in procedures at the same precision and the same units of measure that they are presented on instrument panel displays.

[4] Express consecutive acceptable values as a range of values rather than in terms of tolerance bands. Tolerance bands require additional mental calculation on the part of the users, increasing the probability of error.

EXAMPLE 3-3. - Use of spelled-out numbers with emphasis.

Use: "if the temp is 75E to 85E F..."
or: "if the temp is 80E F (acceptable range of 75E to 85E)"
Do not use: "if the temp is 80EF ± 5EF..."

3.1.6 Typeface

The readability of type is affected by its font (typeface, point size, and weight), and case (capitalized versus uncapitalized).

[1] Select typeface font and size so that it is readable under the worst conditions anticipated. Ensure that the type size is large enough for users to read at anticipated distances and lighting conditions.

[2] Use a mixture of both upper and lower case in text. Only use capital letters for emphasis of single words or phrases, not for an entire block of text.

3.1.7 Page Headers and Page Numbering

Each page of the procedure should include a main page header that fits at the top of the page and clearly distinguishes a specific identity for each procedure. The identity of a procedure should include a unique number and the unit (building or system) to which it applies.

[1] Place the page header at the top of every procedure page.

[2] Ensure margins are adequate on all sides so that information is not lost during duplication. Surrounding the text area with a box is one method to ensure information is not lost.

[3] Include the following in the front page header:

- Procedure title
- Procedure number
- Revision number
- Revision date.

[4] Include sufficient information on successive pages to identify the procedure to which the page belongs (for example, procedure number and revision).

[5] Number pages consecutively. Begin with the coversheet (which is page 1) and continue to the end.

[6] Establish the location of the page number and consistently maintain the location for all procedures. Designate the page number as "Page __ of __," (for example, "Page 5 of 23"). Label the main page header in appendix pages with the parent procedure revision number and revision date.

[7] Maintain the page numbering sequence and use an internal appendix page number as shown in the following example.

EXAMPLE 3-4. Internal page numbering for an appendix.

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(Page 1 of 1)

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[8] Ensure the header information clearly communicates the specific use and applicability of the procedure; the number, in conjunction with the title, must state the unit (building or facility) to which the procedure relates.

3.1.8 Procedure Titles

[1] Write procedure titles that are concise, clear, and descriptive of the system, equipment, process, or activity.

[2] Write procedure titles that are short and descriptive enough to permit the user to easily identify the procedure and activity to which the procedure applies.

[3] Write unique procedure titles to assist the user in identifying the correct procedure.

EXAMPLE 3-5. Procedure title.

Reservoir Plug Welding

3.1.9 Headings

Headings break the text of the procedure into sections by grouping related action steps. Section headings help users locate information in the procedure, break up long series of actions into manageable chunks, and track their progress through the procedure, especially when branching to other sections.

[1] Give each major activity in the main body of the procedure a unique and descriptive heading.

[2] Limit the number of heading levels to three (for example, 1, 1.1, and 1.1.1). Excessive levels result in complex section numbers.

[3] Identify first-, second-, and third-level headings by a decimal numbering system.

[4] Begin first-, second-, and third-level headings at the left margin of the text block.

[5] Identify first-level headings with all capital letters and bold type.

[6] Identify second- and third-level headings with initial capital letters of important words and bold type.

[7] If second-level headings organize activities, start the headings with the “ing” form of action verbs and complete the headings with the objects of the action verbs (for example, **Starting Cooling Water Pumps**).

[8] If the third-level headings under a second-level heading are being used to organize action steps, start the headings with action verbs and complete the headings with the objects of the action verbs (for example, **Start the Cooling Water Pump**).

[9] Otherwise, use topics for second- and third-level headings (for example, **Cooling Water Pumps)**.

[10] Use a list to organize material other than action steps under headings and action steps.

[11] Designate listed items with indented upper-case letters.

EXAMPLE 3.6 - Headings.

1 FIRST LEVEL HEADING

1.1 Second-Level Heading

1.1.1 Third-Level Heading

[1] First-level action step

[2] First-level action step with two second-level action steps

[a] Second-level action step
[b] Second-level action step

[12] If it is necessary to continue a section on subsequent pages, repeat the heading on subsequent pages with an indication that the page is a continuation.

EXAMPLE 3-7. Section heading and indication of section continuation.

3.2 Special Tools, Equipment, Parts and Supplies (continued)

3.1.10 Action Step Numbering

Action steps reduce a task or activity to a discrete set of instructions. Action step numbering identifies individual action steps and their sequence.

[1] Make action steps readily distinguishable by the user.

[2] Limit the number of action step levels to two.

[3] Identify first-level action steps with bold typeface bracketed numbers.

[4] Identify second-level action steps with bold typeface bracketed lower-case letters.

EXAMPLE 3-8. First-level action step with two second-level action steps.

[3] Prepare compressed gas cylinders.

[a] Select compressed gas cylinders with current in-service dated gas certification.

[b] Verify that each cylinder regulator will maintain 35 psig (30 to 40).

3.2 Procedure Organization

A technical procedure is organized to provide the procedure user with all the needed information to accomplish an activity. It includes the following elements:

- Coversheet
- Revision status
- Table of Contents
- Introduction
- Precautions and limitations
- Prerequisite actions
- Acceptance criteria
- Performance
- Post-performance activity
- Source requirements
- Appendixes.

Not all procedures require each of these elements. For example, not every procedure needs an appendix. If the procedure does not need an element, do not include it. The contents and format for each of these procedure elements are discussed in the following sections of this guide.

3.2.1 Coversheet

The coversheet provides a means for the user to verify that the procedure is appropriate for the task at hand.

[1] Provide a simple descriptive title that identifies the system, equipment, process, or activity described in the procedure.

[2] Include other information, as needed, to differentiate the procedure from other procedures (for example, specific conditions or activities that the procedure controls). Example 3-9 contains a sample coversheet.

EXAMPLE 3-9. Coversheet

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Reservoir Plug Welding

Building 618

PERFORMANCE SECTIONS:

[4] RESERVOIR CHECK-IN AND ACTUATOR REMOVAL

[5] WELD PREPARATION

[6] PLUG WELDING

[7] DECONTAMINATION OF RESERVOIRS

[8] RESERVOIR STORAGE

Approved By:_____

3.2.2 Revision Status

It is essential that users follow the most current version of a procedure. Document control systems typically ensure the most recent versions are available. Ensure the latest revision is used by including the revision number on each page of the procedure.

Draw the user's attention to changes (additions, corrections, or deletions) made in the procedure. A clear, simple means of marking these changes is required. One suggested method is to mark the changes with vertical lines in the margin. Only the marks for the most recent revision should appear in the revision.

3.2.3 Table of Contents

The table of contents helps users locate the portions of the procedure they need for a specific operation and is useful for locating appendixes. A table of contents is recommended.

[1] List the procedure section and subsection headings and the titles of appendixes exactly as they appear in the procedure.

[2] List third-level subsection headings in the table of contents when required by the length and complexity of the procedure (listing third-level headings is optional).

[3] Identify at the right margin of the Table of Contents, the number of the page on which the heading or title first appears.

[4] Format the table of contents consistently (Example 3-10 contains a sample table of contents).

EXAMPLE 3-10. Table of contents showing layout and format.

TABLE OF CONTENTS

1 INTRODUCTION 3

1.1 Purpose 3
1.2 Scope 3
1.3 Applicability 3

2 PRECAUTIONS AND LIMITATIONS 3

3 PREREQUISITE ACTIONS 4

3.1 Performance Documents 4
3.2 Special Tools, Equipment, Parts and Supplies 4
3.3 Approvals 5

4 RESERVOIR CHECK-IN AND ACTUATOR REMOVAL 5

4.1 Checking in the Received and Unpackaged Reservoirs 5
4.2 Removing the Actuator 6

5 WELD PREPARATION 8

5.1 Preparing Reservoirs that have Stems that CAN be removed with Pliers 8
5.2 Preparing Reservoirs with a Stem that CANNOT be removed with Pliers 9

6 PLUG WELDING 9

7 DECONTAMINATION OF RESERVOIRS 15

8 RESERVOIR STORAGE 15

9 POST PERFORMANCE ACTIVITY 15

APPENDIX A -- Check Sheet/Data Sheet 16

3.3 Introduction

The introduction should address the purpose, scope, and applicability of the procedure.

[1] Provide a clear description in the purpose of the goal to be achieved by performing the procedure. Avoid purpose statements that repeat the procedure title and headings of the table of contents.

EXAMPLE 3-11. A typical purpose statement.

1.1 Purpose

This procedure provides instructions for reservoir plug welding and storage of plug welded reservoirs.

---

[2] Describe the activities the procedure covers in a statement of scope. If necessary, the scope may also address the limitations of the procedure (what the procedure does not cover). Example 3-12 contains an outline of a scope for a technical procedure.

EXAMPLE 3-12. Outline of a scope for a technical procedure.

1.2 Scope

This procedure addresses the actions necessary to plug weld reservoirs, to decontaminate them, and to store them. It does not include receipt and unpackaging of reservoirs, nor does it address rework of improperly welded reservoirs.

---

[3] Specify the conditions that require procedure use in the applicability statement. For example, in a surveillance test procedure the applicability statement might be that the test has been requested by a manager.

3.4 Precautions and Limitations

Failure to include precautions and limitations within the procedure can cause a severe injury to, or the death of, the procedure user and/or serious damage to equipment.

The precautions and limitations section delineates precautions that affect the entire procedure or that occur at more than one point in the procedure.

[1] Write precautions and limitations to inform users of hazardous conditions and their potential effects. Precautions (a) alert procedure users to actions and conditions that represent potential hazards to personnel or possible damage to equipment or (b) establish abnormal conditions. Limitations define boundaries that are not to be exceeded.

[2] Do not present user actions in the precautions and limitations section.

[3] Avoid generic precautions that are part of a job description or inherent in the task.

[4] Present hazardous conditions that exist during the entire procedure or occur at more than one point in the procedure.

[5] If action is required by users to respond to the precaution or limitation, provide action steps at the appropriate location in the procedure and use a conditional action step to define the conditions that require an action. (See Section 4 for information on writing action steps.)

[6] Address the following in precautions and limitations as appropriate.

[a] Identify and address potential exposure of personnel or the environment to

- Radiation or contamination
- High temperature or high pressure fluids
- Hazardous substances
- Electrical shocks
- Excessive noise levels
- Confined space hazards
- Falls
- Moving equipment or parts of equipment
- Fire hazards.

[b] Identify and address the protection of equipment and material from

- Inadvertent, incorrect, or omitted actions that may cause facility shutdown

- Inadvertent, incorrect, or omitted actions that may result in limiting conditions for operation as defined in the technical safety requirements
- Limitations identified in approved vendor information
- Limitations identified in applicable design documents
- Unusual alarms affecting facility availability that may occur or are expected to occur as a result of performing the procedure
- Mechanical or electrical bypasses (lifted leads, inhibits, jumpers, and fuse removals) used in performing the procedure
- Electrical and mechanical interlocks involved in performing the procedure
- Actions resulting in emergency response or automatic incident response
- Undesirable consequences of violating each precaution or limitation statement.

EXAMPLE 3-13. Precaution statements.

2 PRECAUTIONS AND LIMITATIONS

2.1 Vapor pressure thermometer capillary tubing can be damaged if rolled up less than 8 inches in diameter.

2.2 The instrument terminals may carry hazardous electrical currents. You may receive severe or fatal electric shock if you touch these terminals without protection.

EXAMPLE 3-14. Limitation statement

2 PRECAUTIONS AND LIMITATIONS

2.1 The unavailability of the standby motor generator during power operations may exceed a technical safety requirements limiting condition of operation.

Hazardous conditions that apply to individual action steps are written as warnings or cautions; they are placed just before and on the same page as the affected action step. (See Section 4, "Action Steps with Warnings, Cautions, and Notes," for information on writing warnings and cautions.)

3.5 Prerequisite Actions

The prerequisite actions section identifies actions that must be completed by the user and requirements that must be met and signed off before the user continues with the procedure.

[1] Include the following subsections in the prerequisite actions section as applicable:

- Planning and coordination
- Performance documents
- Special tools, equipment, parts, and supplies
- Field preparations
- Approvals and notifications.

[2] Vary the sequence of procedure subsections as appropriate; the sequence of subsections should be determined by the sequence of the actions to be performed. For example, an approval might be needed before a field preparation.

[3] Arrange action steps in an order ensuring that all required permissions and notifications are obtained before any facility equipment is manipulated.

[4] If the procedure is generic, include only those prerequisite actions that apply to all uses of the procedure. Application-specific prerequisite actions, including data sheets, are contained in separate procedures. Administrative prerequisites for maintenance may be included in work-initiating procedures. For example, a generic procedure to change out a pump seal would include only those prerequisites applicable to the seal change out. The prerequisites for taking the specific pump out of service are contained within the specific pump procedure.

[5] Include provisions for recording data, signoffs, and remarks discussed in the following subsections as needed.

3.5.1 Planning and Coordination

The planning and coordination section includes information on activities that must be undertaken to plan and coordinate the performance of the procedure. These actions may include, but are not limited to, the following:

[1] If training or qualifications specific to the procedure are required, list personnel requirements.

[2] Include instructions for a pre-job planning meeting with the participants as appropriate. For example, a pre-job meeting may include coordinating activities at several locations, planning detailed measurements to be taken by several persons, or other aspects of performing a complex procedure.

[3] Provide administrative requirements (such as the statement "Verify the procedure to be used is a copy of the current revision") to ensure the user has the latest revision.

[4] Provide action steps to ensure needed information is obtained and recorded. These action steps may involve:

- Identifying the principal personnel involved by functional responsibility (see Section 4, "Writing Basic Action Steps," and "Actions Steps Containing Verifications, Checks, Notifications, and Data Recording").

- Recording the facility condition at the start and end of the procedures and the date and time the procedure is started.

- Justifying and identifying portions of the procedure that are used.

[5] Address any special system conditions and hold orders required to perform the work.

3.5.2 Performance Documents

[1] Direct the user to obtain all other documents required to perform the procedure, such as drawings, approved vendor manuals, and other procedures that may be referenced in the base procedure. Listing these references in the prerequisite actions subsection ensures that the documents are available at the job site when needed. Where feasible, however, include such material in the base procedure to lessen the number of references the user must refer to.

3.5.3 Special Tools and Equipment, Parts, and Supplies

[1] List special tools, measuring and test equipment, parts, and supplies required to perform the procedure. Strict attention to the completeness and correctness of this

section is extremely important. For example, failure to specify a necessary item could result in costly equipment downtime or using a substitute for a specialized tool could damage equipment. It may be appropriate to provide some of this information in tables. Lists of material may be more appropriately placed in an appendix than in this subsection.

[2] Identify certified or qualified parts and equipment needed for the activities.

[3] Provide guidelines for selecting and assembling special tools, measuring and test equipment, parts, and supplies.

[4] Provide separate action steps for the different categories such as parts, supplies, or measuring and test equipment.

[5] Specify alternative tools and equipment if applicable.

EXAMPLE 3-15. Table identifying required parts.

[3] Obtain the following parts:

Description	Part Number	TIIC No.	Quantity	Class
Gasket	3	XX-XX-XX	1	EQ
Piston	5	YY-YY-YY	1	EQ
Nut	6	ZZ-ZZ-ZZ	2	NA

[6] Identify specific equipment necessary to perform a procedure.

[7] Avoid using the statement “or equivalent” when specifying equipment.

[8] Do not specify ordinary craft tools such as standard pliers and wrenches.

[9] If the procedure has a generic application, do not include instrument-specific information such as serial number or calibration date. This information is included in application-specific procedures.

[10] Provide clear specifications for verifying the adequacy of test equipment. Specifications include ranges, accuracies, and compliance with calibration standards.

[11] Ensure that range and accuracy of measuring equipment are consistent with the expected values to be measured.

[12] Determine when data concerning test equipment (for example, serial numbers or calibration dates) must be recorded. Provide space in the procedure or in an appendix to record the data before the user encounters action steps which use the test equipment for critical measurements.

[13] Specify verification and performance checks or special controls required before the equipment is used. If the performance check is done just before use, include the check in the body of the procedure rather than in the prerequisite actions section.

EXAMPLE 3-16. Measuring and test equipment identification.

[3] Obtain two stopwatches (calibrated and approved by Quality Assurance Lab), and complete Table 4-2.

TABLE 4-2		
M&TE No.	**Expiration Date**	**Performer Initials**
		_____
		_____

3.5.4 Field Preparations

[1] Provide instructions for preparatory field activities that must be completed before continuing with the procedure. Examples of these activities are listed below.

- Lock-out/tag out of equipment

EXAMPLE 3-17. Tag out action step.

[4] Verify that the GM Diesel unit to be inspected has been tagged out. ___

- Unlocking valves or rooms
- Recording the as-found condition of the structure, system, or component
- Verifying if systems and components are in use before removal from service (for example, redundant safety system or indicator lights)
- Confirming the correct system or equipment configuration
- Establishing system or equipment alignment and power supply
- Identifying actions to cope with potential hazards such as fire, radioactive spills, or exposure to radiation
- Installing portable communications equipment and preparing special test equipment
- Identifying needed support services such as craft personnel to remove a relay cover.
- Verifying availability of performance documents before continuing with the procedure.
- Providing specifications and tolerances that determine whether the results of the prerequisite action steps are acceptable
- Obtaining required permits such as radiation work, electrical work, or confined space work permits. Ensure appropriate signoffs and approvals are obtained.

EXAMPLE 3-18. Field preparations.

[4] Verify that the halon fire protection system is in service for each GM Diesel room. ___

[5] Ensure that the following tests have been completed on the GM Diesel to be tested:

A. SP-EG-100 series. ___
B. SP-EG-1. ___

3.5.5 Approvals and Notifications

The approvals and notifications section identifies approvals and notifications that must occur before the actions in the procedure begin. Approvals and notifications related to specific action steps in the procedure are placed adjacent to the affected action step.

[1] Provide instructions to ensure that all necessary approvals are obtained and all required notifications are made before initiating the procedure. Approvals and notifications may involve responsible individuals such as:

- Shift manager
- Central control room operator of the affected units
- Responsible system or equipment engineer
- Support, quality control, regulatory, and audit personnel
- Health physics and chemistry technicians.

EXAMPLE 3-19. Approval to begin a procedure.

3.3 Approvals

[1] Consult with, and obtain permission from, your supervisor before beginning performing this procedure

_____
Supervisor Initials

---

[2] If a work package encompassing activities performed in a procedure does not include instructions to obtain permits before performing the activity, provide instructions for obtaining the required permits (for example, radiation work or confined space entry permits).

[3] Provide for notifications if they are required in the event of a delay.

EXAMPLE 3-20. Notifications in case of delay.

[2] IF the test is delayed until a later shift,
THEN obtain approvals to begin or continue the test from the following individuals:

Position	Signature	Date	Time
Shift Manager			
Central Control Room Operator			
Shift Technical Engineer			

3.5.6 Terms, Definitions, Acronyms, and Abbreviations

Avoid using a separate section devoted to terms, definitions, and acronyms in technical procedures. Users should be adequately trained and familiar with the terms used in the procedure. Facility-specific glossaries of terms, definitions, acronyms, and abbreviations should be maintained to ensure consistent use of these elements and consistent interpretation by the user. If the writer decides a term needs amplification in a specific procedure, the amplification should appear in a note preceding the affected action step or be incorporated in the action step.

3.5.7 Responsibilities

In technical procedures, responsibilities are implicit in the action statements (see Section 4 of this guide for information about writing action statements). Only action steps that involve personnel in addition to the user need specify the person responsible for a specific action. Therefore, because the procedure has a limited number of users, a separate responsibilities section is not warranted.

3.6 Performance Sections

The performance sections contain the action steps that prescribe the principal tasks and subtasks of the procedure.

[1] Organize activities in the order that they will be performed.

[2] Divide the performance sections into subsections that logically group related activities as established in the procedure basis outline.

[3] Use headings for each subsection that reflect the activity rather than a generic title (for example, "Removing the Actuator," rather than "Actuator").

[4] Write the specific action steps within the performance sections in accordance with Section 4 of this guide**.**

3.7 Post-performance Activity

The post-performance activity section stipulates actions needed to close out the activity including testing, restoration, and compiling results.

3.7.1 Testing

[1] If operability of equipment has been affected while performing a procedure and operability has to be verified before returning the equipment to service, include action steps that specify these tests.

3.7.2 Restoration

[1] Provide action steps to specify and record the return of all affected structures, systems, or equipment to the desired configuration.

[2] Include instructions for

- Required restoration adjustments, storage, or maintenance of laboratory and process equipment
- The return of tools and equipment
- The proper disposal or storage of consumables such as test samples or chemicals not used in the process.

[3] Provide space for recording the notification of appropriate personnel that the system has been returned to service.

[4] Include provisions for close out of any permits (such as confined entry permits) that were required to perform the procedure.

[5] Provide for verification of appropriate restoration action steps.

3.7.3 Results

[1] Provide instructions to summarize the results of the procedure including

- Listings of facility conditions
- Date and time of test start and test completion
- Participants
- Reasons for the test

[2] Provide instructions to state whether

- Problems or delays were encountered
- Corrective action(s) were performed
- Authorization signatures were obtained.

[3] Provide instructions to state whether acceptance criteria were satisfied, a nonconformance report was initiated, and/or a limited condition for operation was exceeded.

[4] Provide an action step to review the entire procedure for completion and to review and approve test results.

3.8 Records

Records generated by a procedure are maintained to document the tasks completed by performing the procedure. Administrative controls establish requirements for, and control of, records. Post-task analyses of the procedure require that the conditions of performance and the personnel involved are clearly recorded so lessons can be learned if adverse consequences occur.

[1] Identify the records generated as a result of performing the procedure in the performance section (for example, forms, data sheets, checklists, and documentation of as-found conditions).

[2] Classify the records generated as appropriate to facility records control and indicate the appropriate filing or transmittal of the records.

[3] If no records are generated, state this in the procedure**.**

3.9 Source Requirements

Source requirements are requirements implemented by the procedure. There should be a cross-reference between these requirements and the parts of the procedure which implement them. Source requirements are identified in this way to alert users who are making an expedited procedure change.

[1] Identify within the procedure the parts of the procedure which implement a source requirement.

[2] List the DOE rules and orders, technical safety requirements, safety analysis reports, and other requirements and commitments directly implemented by the procedure (for example, industry codes and standards). Source requirements are identified when the basis for the procedure is established.

[3] Do not include broad, programmatic documents unless there is a specific purpose for the reference.

[4] Identify the specific requirements (and their locations) within the source requirements documents of the requirements that are implemented by the procedure.

[5] Ensure that the authorized versions of the source requirement documents are listed. For example, the codes and standards in effect when the facility was designed, not the most recent versions, normally apply unless a modification, commitment, or technical safety requirement change invokes a more current version.

[6] Do not include documents listed as performance documents.

[7] If there is more than one type of source requirement document, use subheadings to list them. For example,

- DOE rules and orders
- Technical safety requirements and safety analysis reports
- Industry codes and standards.

3.10 Appendixes

Provide appendixes when the material and function of the procedure require them. Appendixes are part of the procedure; number pages to show they are a continuation of the main body of the procedures. In addition, number appendixes independently to ensure all pages are available if the appendix is detached from the main body of the procedure.

Examples of items that may be placed in an appendix are forms, tables, figures, graphs, and some checklists that are too large to incorporate in the sequence of action steps.

[1] Reference appendixes within the text of the procedure.

[2] Include in appendixes information more conveniently located outside the main body of a procedure. Example 3-21 illustrates a suggested format for a valve alignment checklist.

EXAMPLE 3-21. Valve alignment checklist.

SHIELD HX CW				SP-SHS-1-K Rev. 0 Page 19 of 23
APPENDIX D SHIELD SYSTEM HX COOLING WATER SUPPLY & VALVE ALIGNMENT CHECKLIST (Page 1 of 2)				
Component Noun Name	Description (Location)	Valve Number	Required Position	Initials
Bypass effluent to HX		CWS-V-272D	OPEN	__ __ IV
Flow pressure tap		CWS-V-1513	OPEN	___

[3] Avoid using vendor information as appendixes.

[a] Integrate approved vendor information into procedures, when possible, rather than referencing the information.

[b] Refer to administrative requirements for processing and using vendor information.

4 WRITING ACTION STEPS

The basic element of an action step is an imperative sentence—a command to perform a specific action. An action step answers the question “what is to be done?” Additional elements, such as cautions and condition statements, add precision to instructions.

4.1 Writing Basic Action Steps

EXAMPLE 4-1. Basic action step.

Action Verb	Direct Object	Supportive Information
Label	the actuator disposal can	with Identification Tag Form 45

NOTE **In many requirements documents, required actions are expressed by using "shall" in declarative sentences (for example, "The manager shall approve the completed work order" for "Approved storage shall be provided for classified documents"). The words "will", "should," and "must" are similarly used. In procedures governed by the guidelines in this writer's guide, this type of sentence is not used to express required actions. Imperative sentences (commands) are used instead, as illustrated throughout this guide.**

[1] Start the basic action step with a singular present tense action verb such as open. Appendix E of this guide includes a list of suggested action verbs.

[2] Describe the direct object of the verb.

[a] Identify equipment precisely as it is in the facility.

[b] If the equipment is not labeled within the facility, use equipment nomenclature precisely as it appears in the procedure basis documentation.

[c] Avoid using acronyms and abbreviations when writing action steps, particularly for short, simple words and terms. If an acronym or abbreviation is used, it must (a) be easily understood by the users and (b) have a standardized and unique meaning for the users.

[d] Use only acronyms and abbreviations that are included in an approved, site-specific list.

[3] Complete the basic action step with supportive information about the action verb and the direct object. Supportive information includes further description of the object and the recipient of the object. Acceptance criteria, referencing, and branching are other types of supportive information that are described later in this section.

[4] Identify each action step and action substep with a special identifier (as established in Section 3, "Action Step Numbering") to distinguish the action steps from each other and from topical headings and explanations.

EXAMPLE 4-2. First-level action step with two second-level action steps.

[3] Prepare compressed gas cylinders as follows:

[a] Select compressed gas cylinders with current in-service dated gas certification. ____

[b] Verify that each cylinder regulator will maintain 35 psig (30 to 40 psig). ____

[5] Write action steps using words that are easily understandable by the users. Where a word is used that requires a definition, include the definition as (a) part of that action step or (b) as a note that immediately precedes the action step.

[6] Restructure the actions as needed to avoid using action sub-substeps. Break one section into two or more sections to simplify the action step structure if necessary.

[7] Place three or more objects of the verb in a separate table or listing with appropriate checkoff boxes or signoff blanks.

[8] Consider combining multiple verbs with the same object in a single action statement.

EXAMPLE 4-3. Three action verbs combined in a single action statement.

[12] Sign, date, and transmit completed form to Records Management. _____

[9] If someone other than the primary procedure user is responsible for performing an action step, identify the person to perform the task directly above the affected action step.

EXAMPLE 4-4. Identification of performer of action step.

---

[2] Torque head bolts with torque wrench set at 90 foot-pounds. ____

QA Inspector

[3] Verify that head bolts are torqued to 90-foot pounds. ____

---

[10] Use emphasis techniques (for example, **bold**, *italics*, or <u>underlining</u>) to highlight important information, with the following constraints: (a) do not use all capital letters for blocks of text, (b) do not capitalize the first letter of any words unless they are formal, proper nouns in accordance with standard American English usage or they are the first word of a sentence, and (c) avoid the overuse of multiple emphasis techniques.

[11] Specify numbers in the procedures at the same precision than can be read from the instruments.

[12] Avoid requiring users to make conversions from one unit of measure to another whenever possible. Provide an aid for the user if conversions are essential. Do not require mental calculations.

[13] Use consistent vocabulary, syntax, and punctuation

[a] Include articles (a, an, the) when referring to a general item; omit the article when referring to specific items (for example, "Open <u>the</u> door," "Open door DW-9").

[b] Use punctuation in accordance with standard American English.

[c] Present action steps, including associated action substeps and lists, with a minimum of interruption (for example, page breaks).

[d] Follow standard grammatical principles.

[e] Use words consistently within and among procedures.

[f] Use short, simple words.

[g] Avoid ambiguous or vague adverbs.

[14] Use main action steps to allow users to quickly comprehend the purpose of the action step. Use action substeps to provide specific details for performance. Both main action steps and action substeps use the same basic action step form.

[15] Avoid formatting an action step so that it continues onto the next page.

[16] Present numerical information in Arabic numbers (as opposed to Roman numerals). Use spelled-out numbers only when one number without a specified unit of measure is followed directly by one with a unit of measure or when a number, typically a single digit number, is emphasized.

4.2 Conditional Action Steps

Conditional action steps are used when a decision is based upon the occurrence of a condition or a combination of conditions. The use of conditional action steps is extremely important in technical procedures as they structure the decisions required by the operator. Conditional action steps use the following logic terms:

- IF or WHEN to present the condition to the user
- THEN to present the action
- OR or AND to present more complex conditions
- NOT to negate the condition

Other words (for example, "except", "unless", "but", "only") should never be used to present conditional information.

[1] Describe the condition first and then the action to be taken if that condition applies.

EXAMPLE 4-5. Proper sequence for conditional statements.

[6] IF the plug piece is not clean,
THEN wipe the cone base off with an alcohol moistened cotton swab. ☐

[2] Emphasize conditional terms in procedures. By convention, conditional terms are usually capitalized and underlined. The emphasis techniques used for conditional terms should be applied uniquely to conditional terms. Additionally, white space

can be used to add emphasis in conditional statements, for instance, by starting each new conditional term on a new line.

[3] If two conditions are required and both of these conditions must be met, then place the conditional term AND between the conditions. Begin a new line when presenting the second condition and begin a new line with THEN and the action.

[4] If two conditions are involved and one or both of these conditions must be met before the action is taken, place the conditional term OR in underlined capital letters between the conditions. Begin a new line when presenting the second condition and begin a new line with THEN and the action.

[5] If three or more conditions are described, consider using a decision table or a listing format.

EXAMPLE 4-6. Use of a listing format for three or more conditions.

[6] IF all of the following conditions exist,

A. Condition 1

B. Condition 2

C. Condition 3

THEN open CWS-HMOV-290, ECW pump discharge valve. _____

[6] Avoid using AND and OR in the same conditional statement as the resulting logic can be ambiguous and difficult to understand.

EXAMPLE 4-7. Avoid using AND and OR in the same statement.

Do not use: **[8]** IF condition A OR condition B AND condition C,
THEN open valve D.

Use: **[8]** IF condition A OR condition B,
AND condition C,
THEN open valve D.

[7] Use only AND and OR to join conditions that include both a subject and a predicate. If two subjects apply to the same predicate (for example, "IF temperature and pressure are stable, ...") or one subject takes two predicates (for example, "IF level is stable or falling, ...") use the unemphasized conjunctions "and" or "or" rather than the special emphasized logic terms**.**

EXAMPLE 4-8. Two subjects with one predicate.

---

[5] WHEN cooling water pump and pump discharge pressure have stabilized, THEN close CWS-V-3351-1 bypass isolation valve. ____

---

[8] For a negative condition, use the conditional term NOT. Avoid using NOT if a single word can be used and the condition can be stated in a positive manner. For example, "IF the valve is open, ..." is preferable to "IF the valve is NOT closed, ..."

4.3 Nonsequential Action Steps

Procedure users should perform the action steps in the order they are written unless they are specifically directed to perform action steps in another order. When the objectives of the action steps will be met regardless of the sequence they are performed, then

[1] Sequence the action steps according to usability criteria, such as according to equipment or control board layout, to reduce opportunities for error.

[2] Identify in a consistent fashion that a series of action steps can be performed nonsequentially. Place a note before the sequence of action steps that can be performed nonsequentially, as shown in Example 4-9.

EXAMPLE 4-9. Note announcing nonsequential action steps.

NOTE *The activities in Action Steps **[1]** through **[7]** may be performed in any order.*

---

[3] Provide a checkoff box or signoff line for every action in a series of nonsequential action steps to ensure that action steps are not omitted.

4.4 Equally Acceptable Alternative Action Steps

Equally acceptable alternative action steps are used when it is beneficial for users to be provided with more than one option. It is important to ensure that only one alternative is performed.

[1] Present alternative actions as items in a list within a single action step.

[2] Use the word one in lower case underlined to introduce the list of alternatives (for example, “Perform one of the following actions”).

[3] Provide a checkoff line for every action as a series of alternative action steps to ensure that action steps are not omitted and that redundant actions are not performed.

[4] Specify that users only check off those action steps actually performed.

EXAMPLE 4-10. Two equally acceptable action steps.

[1] Perform one of the following actions: Check action taken

- Set Switch S-7 to "ON" ____
- Set Switch S-9 to "ON" ____

4.5 Time-dependent Action Steps

Some action steps contain actions that impose time requirements on the user by specifying the duration of actions or actions that must be completed within a specific period of time.

[1] Place a note before the action steps to be timed in order to alert the user.

[2] Begin the action steps with instructions for the user to record critical time information and provide the user with a place to record this information. Typically this information will be the time that “starts the clock,” and the time by which some action step or action must be completed.

[3] Include guidance to identify the actions to take in the event that the time-dependent action step cannot be performed within the specified time.

EXAMPLE 4-11. Time-dependent action steps.

NOTE *The following action step starts a time-limited sequence. Action steps **[2]** through **[5]** are to be performed within 20 minutes.*

[1] Calculate the time by which action step **[5]** is to be completed by the following steps: ___

[a] Record the time that action step **[2]** is to be started. _____

[b] Add 20 minutes. + 20 minutes

[c] Record the time that action step **[5]** is to be completed. _____
Complete by

[2] Place the Incident Action switch to TEST. ____

[3] Verify the amber *ALARM TEST* light on the AIA graphic panel is LIT. ____
IV

[4] Place the *Incident Action* switch to OFF. ____

[5] Push the *RESET* pushbutton on the AIA logic tester and record the time. _____

[6] IF the time recorded in action step **[5]** is later the time recorded in action step **[1] [c]**, THEN REPEAT action steps **[1]** through **[5]**.

[4] A note advising of time-dependent actions and instructions to record the time information are not required when the time requirement is an inherent part of the action step and misunderstanding is unlikely.

EXAMPLE 4-12. Time-dependent action step.

[1] Push *Generator Start* pushbutton, and verify that the Generator started within 12 seconds.

_____ _____ ____
Time to Start Initial IV

4.6 Concurrent Action Steps

Concurrent action steps contain actions that must be performed at the same time. For example, parameters may have to be monitored or checked while the user accomplishes another action, or two performers in different locations may have to execute actions simultaneously.

[1] If concurrent action steps are to be performed by one person, place those actions in one action step that describes precisely the relationship between the action steps.

[2] If concurrent action steps are to be performed by more than one person, place a note before the first concurrent action step, as appropriate, identifying

- Concurrent action steps
- Personnel needed to perform each concurrent action step
- Locations where the action steps are performed
- Means of communication between locations.

4.7 Continuous Action Steps

Continuous action steps are conditional action steps where the conditions they describe must be monitored throughout a procedure or a portion of a procedure. For example, a user may need to monitor a gauge and take a specific action if the gauge, at any point during the procedure, indicates a reading above or below a specific level.

[1] Place continuous action steps in the procedure at the point at which they first apply. Repeat the action steps periodically, as appropriate, on the facing pages of the procedure or in the body of the procedure.

[2] Format continuous action steps as conditional action steps and state the portion of the procedure during which they are applicable, as shown in Example 4–13.

EXAMPLE 4-13. Continuous action step.

---

[7] IF at any time while performing Action steps [9] through [17] condition X exists, THEN take action Y.

---

[3] Notify the user when continuous action steps are to be discontinued.

4.8 Repeated Action Steps

Repeated action steps are simple action steps that must be performed more than once during the execution of a procedure.

[1] If an action step must be repeated an indefinite number of times to achieve an objective, specify that the action step is to be repeated until the expected results are achieved. Only a single signoff line is provided for this action step regardless of the number of times the action step is performed.

EXAMPLE 4-14. Repeated action step.

[8] Vary input signal until switch SW-1-7 trips. ___

[2] If it is important to know the number of times the sequence is repeated, provide placekeeping (see Section 4, "Placekeeping").

[3] If an action must be performed repeatedly at timed intervals, place instructions in the procedure and provide suitable space to record the times that the action step is performed.

[4] If an action step is to be performed periodically throughout a procedure or a portion of a procedure (but not at specific timed intervals), place reminders as action steps in the body of the procedure.

[5] If a large group of repetitive actions is required and becomes cumbersome, address the actions in action steps that reference a table, a list, or an appendix (an example of a large group of repetitive actions is a series of valve alignments).

[6] Notify the performer when repeated action steps are to be discontinued**.**

4.9 Action Steps Containing Verifications, Checks, Notifications, and Data Recording

Verification action steps assure that a specific activity has occurred or that a stated condition exists. Manipulation by the user may be required. Check action steps call for a comparison with stated requirements; and no manipulation by the user occurs. Notification action steps require reporting when given criteria are met. Data recording action steps assure that desired data are recorded.

[1] Provide appropriate space or tables for entering data (either in the procedure or in data sheets).

[2] If the condition to be verified or checked is not found, provide the appropriate actions to take.

[3] Include labeled lines in action steps as necessary for users to record required information.

EXAMPLE 4-15. Format for data recording of individual action step showing sign off by initials.

---

[10] Record cooling water flow to Cylinder 12 Cooling Jacket.

_____	_____	_____
Required GPM	Actual GPM	Initials and date

---

[4] Specify required independent verification and inspection action steps (the number of independent verification and inspection action steps increase as the consequences of performance error increase).

[5] Include directions for notifying other personnel as discrete action steps. Actions requiring notifications of others often include

- System alignments to be performed.
- Systems to be removed from or returned to service.
- Alarms and alarm setpoints that may annunciate as a result of performing the procedure.
- Equipment actuations that are expected to occur during performance of the procedure.
- Actions with electrical or mechanical interlocks involved (e.g. interlocks to be honored or overridden).
- The effects of precautions and limitations on the operating conditions, noting which equipment will be inoperative and which lights, alarms, or annunciators will react.

- Changes or special conditions established by the procedure that could affect or appear to affect other equipment or systems. For example, performing the procedure could involve mechanical or electrical bypass (lifted leads, inhibits, jumpers, and fuse removals) or other functional restrictions.

- Methods and instructions for communication among multiple persons required to perform an action.

- Inspection for degradation of qualified equipment (for example, environmentally qualified or seismically qualified equipment).

[6] Identify parameters and acceptable ranges needed to perform the procedure.

[a] Use the same units of measure in the procedure that users will read from the facility instrumentation.

[b] If there is an acceptable range for a parameter, include the acceptable range rather than a point value.

4.10 Action Steps with Warnings, Cautions, and Notes

Warnings alert users to potential hazards to personnel. Cautions alert users to potential hazards to products or equipment. Notes call attention to important supplemental information.

4.10.1 Warnings and Cautions

Warnings and cautions attract attention to information that is essential to safe performance; they usually consist of the conditions, design limitations, practices, and procedures to be complied with to avoid loss of life, personal injury, health hazards, or damage to equipment. An industry study of significant events attributed one-fourth of all human performance events to a failure to provide proper warnings and cautions.

[1] Review potential hazards with facility technical specialists to determine warnings or cautions that need to be included.

[2] Determine those parts of the procedure where the addition of information is necessary.

[3] Review each action step and list the potential hazards in warning or caution format.

[4] Position warnings and cautions so they are complete on one page and appear immediately before and on the same page as the action step(s) to which they apply.

[5] Place warnings ahead of cautions whenever more than one type is used at the same point in a procedure.

[6] Do not include action steps in warnings and cautions.

[7] Write warnings and cautions as short, concise statements. Write warnings and cautions as statements rather than as commands to distinguish them from action steps (for example, "Touching this wire will electrocute you!"). Do not embed an action step in a warning format (for example, do not rewrite the instruction "Shut the valve," as "The valve should be shut").

[8] Ensure that cautions and warnings provide (a) a description of the hazardous condition, (b) the consequences of failing to heed the warning or caution, and (c) critical time considerations.

[9] Present the text of warnings and cautions using appropriate techniques to ensure visual identification. (Do not use all capital letters to distinguish warnings and cautions because they are hard for users to read.)

[10] Include only one topic in each warning or caution.

[11] Number each warning or caution when more than one exists (see Example 4-16).

[12] If the danger is present during the entire procedure, place the warning or caution in the precautions and limitations section.

[13] Repeat the information in precautions as separate cautions or warnings within the body of the procedure as it applies to individual action steps.

[14] Avoid overusing warnings and cautions**.**

EXAMPLE 4-16. Numbered cautions.

CAUTION 1

Operating the generator system at speeds less than 700 rpm for longer than 10 minutes with the exciter regulator in operation may cause damage to the exciter regulator field.

CAUTION 2

In the event of a power failure, emergency equipment will start and overload the diesel if the diesel is isolated on the emergency bus during testing.

4.10.2 Notes

Notes call attention to important supplemental information. The information can be a reminder of preparatory information needed to perform the activities of a procedure or action step.

[1] Use notes to present information that assists the user in making decisions or improving task performance.

[2] Position notes so they are complete on one page and appear immediately before and on the same page as the action step(s) to which they apply.

[3] Place warnings and cautions ahead of notes whenever more than one type is used at the same point in a procedure.

[4] Do not include action steps in notes. Embedded actions should be removed from the note and written as action steps.

EXAMPLE 4-18. Note presentation.

C Wrong form: contains a hidden command

NOTE *A timed duration starts when fluid collection begins. Time is measured and fluid is collected from the end of the test hose (at the floor drain) into a graduated cylinder.*

C Correct form: rewritten to remove embedded action step

NOTE *A timed duration starts when fluid collection begins in Action step [12] below.*

[12] Collect fluid from the end of the test hose (at the floor drain) into a graduated cylinder.

---

[5] Number the notes if more than one note is entered at the same location in a section or subsection.

EXAMPLE 4-17. Numbered notes.

NOTE 1 *The following action step closes generator breaker G-1 and starts diesel DL-I.*

NOTE 2 *The following action step requires a time measurement starting at the initiation signal.*

[6] Write notes as short, concise statements. Write notes as statements rather than as commands to distinguish them from action steps (for example, “The following action step starts a timed duration.”).

[7] Use appropriate emphasis techniques (for example, *italics*) to distinguish notes from cautions or warnings.

[8] Include only one topic in each note.

[9] Avoid overusing notes.

4.11 Action Steps Directing Users Elsewhere—Branching and Referencing

To perform a task, sometimes users must branch or reference another procedure, section, or appendix. Branching routes the procedure user to other action steps or sections within the procedure or to other procedures, and the user does not return to the original position. Referencing routes the procedure user to other action steps or sections within the procedure or to other procedures and then back to the original position in the base procedure.

Referencing and branching increase the potential for error with attendant safety and administrative consequences. Therefore, branching and referencing are highly discouraged. Use referencing and branching only when it is necessary to direct the user to information that is vital to the performance of the activity and it is not appropriate to incorporate that information into the base procedure.

[1] Evaluate the following criteria to determine if referencing or branching is appropriate. If the answer to all of the following is "NO", then referencing or branching may be appropriate.

- Can action steps be readily incorporated rather than referenced?
- Will branching and referencing decrease user comprehension and ease of use?

- Will users be directed to small, isolated sections, rather than whole procedures or appendixes?

- Will branching and referencing cause users to bypass prerequisites that affect the section to which they are being directed.

- Will branching and referencing cause users to bypass precautions and limitations that affect the section to which they are being directed.

[2] If referencing or branching is appropriate, then use the following methods for referencing and branching:

[a] Make it clear to the users that they are being directed to other material. Do not expect them to know implicitly that other material is being referenced.

[b] Fully specify the location the user is to go when cross-referencing. If the user is being sent to another procedure, identify the procedure number, title, and section of the procedure. If the user is being sent to another location in the base procedure, identify the specific location in the procedure.

[c] Use a consistent format for presenting cross-references. Emphasize key words consistently so that users can identify a cross-referenced action step.
Use a term such as GO TO presented in all capital letters to indicate departure from the base procedure.

[d] If referencing, use the term RETURN TO presented in all capital letters to indicate the reentry point into the base procedure.

[e] If referencing, use the terms GO TO and RETURN TO in the same action step.

[f] Ensure that a reference or branch directs the user to all material needed as a prerequisite to the identified material. For example, ensure that in executing a reference or branch, the user does not bypass an applicable caution or prerequisite action step.

Data sheets are used exclusively for recording information, not prescribing how action steps are to be completed. Therefore, the referencing and branching techniques of this section are not applicable to data sheets.

4.12 Action Steps with Acceptance Criteria

Acceptance criteria provide a basis for determining the success or failure of an activity. Acceptance criteria may be qualitative (specify a given event that does or does not occur) or quantitative (specify a value or value range).

[1] Determine where specific acceptance criteria are to be presented in the procedure. Either or both of the following methods can be used.

[a] State the location of acceptance criteria, whether located at individual action steps (used when criteria are satisfied at the time of performance) or located in data sheets or other procedures. When acceptance criteria are located in other procedures, link procedures using referencing techniques if the information cannot be included in the procedure.

[b] Provide a summary of the acceptance criteria in a table or a list as an appendix.

EXAMPLE 4-19. Statement regarding the location of acceptance criteria

Summary of Acceptance Criteria

Specific quantitative or qualitative requirements that are intended to be verified by this procedure are noted in the action step(s) where the verifying action is performed and recorded.

[2] Include instructions for notifications to be made or actions to be taken immediately by the user, in the event that specified acceptance criteria are not met.

[a] Place these instructions or actions in the body of the procedure.

[b] Ensure that these actions are consistent with administrative instructions.

[3] Include subsequent notifications and actions, such as those to be taken by reviewers, with the acceptance criteria.

EXAMPLE 4-20. Notification of failure to meet acceptance criteria.

[14] IF specific acceptance criteria stated in action steps **[15]** through **[19]** are not met, THEN notify the shift manager as soon as practical after observing the nonconformance.

[4] Use acceptance criteria that consist of nominal values and, if available from the procedure basis, allowable ranges.

4.13 Action Steps with Placekeeping and Sign Offs

4.13.1 Placekeeping

Placekeeping helps users to keep track of their progress in a procedure and reduces the probability of omitting or duplicating action steps. The placekeeping mechanism typically consists of checkoff boxes.

[1] If initials or signatures are not required, provide a placekeeping checkoff box near the right margin of the page or the right side of a table.

EXAMPLE 4-21. Check off box for placekeeping at the action step.

---

[8] Turn the transformer test switch to the TEST position. ☐

---

[2] If placekeeping must be performed on a separate checklist, arrange the placekeeping items in the order the actions are to be performed and reference the associated action steps in the procedure on the checklist.

4.13.2 Sign Offs

Written responses for action steps that require independent verification, inspection, data recording, or documentation of completion can also be placekeeping devices. The use of signatures, initials, check marks, and "N/A" should be defined in site-specific administrative procedures. A signoff action step includes one or more of the following elements:

- A blank line for verification, notification, or inspection signatures or initials
- A blank line for sign off by a person other than the user
- Blanks for recording data and the initials or signatures of persons recording the data.

[1] If procedures require that action steps be signed off, provide space for the sign off of the action step.

[2] Provide a space for the date and/or time of a signoff where such information is determined to be useful.

[3] Position a blank signature or initial line (for entering initials that identify the persons signing off the action step) immediately following the affected action step, or on a separate data sheet or checklist, if necessary.

[4] If the signoff is located in one procedure and the action to be signed off is located in a referenced procedure, indicate in the base procedure action step that documentation occurs in the **referenced procedure signoff space.**

EXAMPLE 4-22. Verification by the user showing sign off by initials.

---

[14] Verify ISV Pump A discharge valve (ISV-A-D2) CLOSED. ____

---

[5] Use the following methods to differentiate between sign offs required of the user and those required of other personnel.

[a] If the action step is to be signed off by someone other than the principal user, place the title or function of the responsible person under the blank line.

[b] If the action step is to be signed off by the user, place no identifying title or function under the blank line.

[6] Do not combine two closely related actions each requiring a sign off into a single action step. Make two separate action steps with individual sign offs.

[7] If an independent witness or other second sign off is needed, provide an additional space for initials and identify that an IV (independent verification) sign off or other specified signature is required.

EXAMPLE 4-23. Independent verification or second sign off of same action step showing sign off by initials.

---

[13] Verify safety system pneumatic valve (ISV-P-2) CLOSED. _____ ____
IV

---

[8] Identify action steps requiring a hold point (action steps that require inspection of the actions performed). Inspections of the results of a action step before initiating

successive action steps are normally designated as hold points. Hold points may involve quality assurance, health physics, engineering, or other inspectors.

EXAMPLE 4-24. Action and hold point verification sign off in the same action step.

Hold Point:

[3] Torque head bolts with torque wrench set at 90 foot-pounds.

_____
QA Inspector

[9] Include places for entering initials or signatures to identify persons recording data when presenting action steps in tables.

EXAMPLE 4-25. Sign off of a series of data points.

Parameter	Tolerance	As Found	As Left	Initials
Pressure	290 psig (285 to 295)			__ __ IV
Temperature	350EF (345 to 355)			__ __ IV
Level	20 ft (19.5 to 20.5)			__ __ IV

4.13.3 Sign Off or Check Off of Conditional Action Steps

In some instances, performing an action depends on a condition or combination of conditions. Conditional action steps are introduced by the words IF or WHEN and are followed by an action.

[1] Provide a space for the user to mark conditional action steps where a sign-off or check-off is desired. Typical entries indicating the appropriate action was taken

are "N/A" if the condition does not occur or a check mark or initial if the condition does occur. Direct the user what to place in the space.

EXAMPLE 4-26. Conditional action step with a sign off.

---

[4] IF outside temperature is less than or equal to 39EF
AND heated air is required,
THEN place coils in service.

____
Enter N/A or Initials

---

5 DEVELOPMENT REFERENCES

1. U.S. Department of Energy, DOE Order 5480.6, *Safety of Department of Energy-Owned Nuclear Reactors*.

2. U.S. Department of Energy, DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*.

3. U.S. Nuclear Regulatory Commission, NUREG-0899, *Guidelines for the Preparation of Emergency Operating Procedures*, August 1982.

4. U.S. Nuclear Regulatory Commission, NUREG/CR-1368, *Development of a Checklist for Evaluating Maintenance, Test, and Calibration Procedures Used in Nuclear Power Plants*, May 1980.

5. U.S. Nuclear Regulatory Commission, NUREG/CR-1369-Rev. 1, *Procedures Evaluation Checklist for Maintenance, Test, and Calibration Procedures*, September 1982.

6. U.S. Nuclear Regulatory Commission, NUREG/CR-1875, *Evaluation of Emergency Operating Procedures for Nuclear Power Plants*, April 1981.

7. U.S. Nuclear Regulatory Commission, NUREG/CR-1999, *Human Engineering Guidelines for Use in Preparing Emergency Operating Procedures for Nuclear Power Plants*, April 1981.

8. U.S. Nuclear Regulatory Commission, NUREG/CR-2005-Rev. 1, *Checklist for Evaluating Emergency Operating Procedures Used in Nuclear Power Plants*, April 1983.

9. U.S. Nuclear Regulatory Commission, NUREG/CR-3177, *Methods for Review and Evaluation of Emergency Procedure Guidelines, Volume 1: Methodologies*, March 1983.

10. U.S. Nuclear Regulatory Commission, NUREG/CR-3177, *Methods for Review and Evaluation of Emergency Procedure Guidelines, Volume 2: Applications to Westinghouse Plants*, March 1983.

11. U.S. Nuclear Regulatory Commission, NUREG/CR-3177, *Methods for Review and Evaluation of Emergency Procedure Guidelines, Volume 3: Applications to General Electric Plants*, September 1983.

Appendix A: Worksheets

	Procedure Basis **Administrative Requirements Worksheet**	**Proc. No.** **Revision** **Page of**
	Title	

Function	Requirement Source	Responsible Position Organization	Addressed in Section/Subsection
Verifications			
Notifications			
Inspections			
Permits or Approvals			

Appendix A

	Procedure Basis **Feedback Worksheet**	**Proc. No.** **Revision** **Page of**
	Title	

Writer Observation or User Comment	Information Source	Addressed in Section/Subsection

Appendix A

	Procedure Basis Activity Worksheet	**Proc. No.**
	Title	**Revision**
		Page of

Instruction Sect./Subject No. _____ Activity No. _____
Activity Description

Participant Position Titles	**Special Training/Qualification Requirements**

Technical Requirements (Equipment ID, setpoints, operating values and ranges, common mode failure, cautions, warnings, limitations)
Level of Detail Considerations (Knowledge and Skill Level, Complexity, Frequency, Consequences, Standardization)
Interfaces (Other personnel or Instructions)

Appendix A

	Procedure Basis **Program Support Requirements Worksheet** **Title**	**Proc. No.** **Revision** **Page of**

Description of Support Activity	Responsible Position/Organization	Addressed in Section/Subsection

Appendix A

	Procedure Basis **Acceptance Criteria Worksheet**	**Proc. No.** **Revision** **Page of**
	Title	

Criteria	Affected Activities	Addressed in Section/Subsection

Appendix A

	Procedure Basis Records Worksheet	**Proc. No.**
	Title	**Revision**
		Page of

Record*	Recommended or Required Retention	QA	Non-QA

*Group in packages, if appropriate

Appendix B: Example of a Technical Procedure

This appendix contains an example of a technical procedure, "Reservoir Plug Welding", which has been structured and formatted according to this guide. The example demonstrates much of the guidance put forward in this writer's guide and supplements the examples given in the text. The procedure was adapted from an actual procedure in use at a DOE facility. The main purpose in adapting this procedure was to illustrate the structure and formatting guidance, not to demonstrate a technically perfect procedure. The adapters did not have access to the procedural basis and so could not verify the technical assumptions implicit in the adaptation.

Parts of the example procedure have been omitted as they provided no additional exemplary material. These omitted sections have been identified in the body of the procedure.

Appendix B

SOP-618-4

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Reservoir Plug Welding

Building 618

PERFORMANCE SECTIONS:

[4] RESERVOIR CHECK-IN AND ACTUATOR REMOVAL

[5] WELD PREPARATION

[6] PLUG WELDING

[7] DECONTAMINATION OF RESERVOIRS

[8] RESERVOIR STORAGE

Approved By:_____

Appendix B

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Appendix B

1 INTRODUCTION

1.1 Purpose

This procedure provides instructions for reservoir plug welding and storage of plug welded reservoirs.

1.2 Scope

This procedure addresses the actions necessary to plug weld reservoirs, to decontaminate them, and to store them. It does not include receipt and unpackaging of reservoirs, nor does it address rework of improperly welded reservoirs.

1.3 Applicability

This procedure is applicable to reservoir Types 1A and 1A with **rings.**

2 PRECAUTIONS AND LIMITATIONS

A. Dropped reservoirs can cause personal injury if safety shoes are not worn.

B. This procedure can cause eye injury if safety goggles are not worn.

C. Filled reservoirs present a radiological hazard. Do not bring filled reservoirs into Building 618.

Appendix B

2 PRECAUTIONS AND LIMITATIONS (continued)

D. Handling unplugged reservoirs presents a chemical release hazard. Do not handle unplugged reservoirs outside of hoods.

3 PREREQUISITE ACTIONS

3.1 Performance Documents

[1] Obtain SOP-618-23, "Performing a Test Weld", which may be needed for performance. ☐

3.2 Special Tools, Equipment, Parts and Supplies

[1] Identify, according to the following table, and obtain the appropriate weld fixtures that will be needed for this batch of reservoirs before proceeding:

Type Reservoir	Electrode Sleeve	Pedestal Fixture Number	Number	
1A	D145795G	4.8.1	D144784-D	☐
1A w/ rings	D144993A w/ 0.5" copper spacer	4.8.2	D145784-D	☐

[2] Obtain conical reservoir plug pieces (Part No. 14678). ☐

[3] Obtain a 0.275 inch electrode. ☐

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3.3 Approvals

[1] Consult with, and obtain permission from, your supervisor before beginning performing this procedure _____

Supervisor Initials

4 RESERVOIR CHECK-IN AND ACTUATOR REMOVAL

NOTE: *SOP-618-3, "Receiving Reservoirs", is used for receiving and unpackaging reservoirs.*

4.1 Checking in the Received and Unpackaged Reservoirs

[1] Complete Check Sheet/Data Sheet (Appendix A) for each received and unpackaged reservoir in the hood. ☐

[a] Record the serial number of the reservoirs ☐

[b] Record the reservoir type ☐

[c] Verify that reservoir is unloaded and mark verification on check sheet ☐

[d] Verify that reservoirs are acceptable to bury by ensuring that the status is "NRR" or "NWR" in the computer system. ☐

Supervisor:

[2] Verify that the serial number(s) on the Check Sheet/Data Sheet (Appendix A) match the reservoir(s) which have been unloaded. ☐

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4.1 Checking in the Received and Unpackaged Reservoirs (continued)

[3] IF any foreign material is around the fill stem area,
THEN remove the foreign material with alcohol and rag and/or grid paper. ☐

4.2 Removing the Actuator

NOTE: *A pair of vise grips, a pair of pliers, or a wrench is used to remove the actuator.*

[1] IF the reservoir is equipped with an actuator,
THEN remove the actuator by the following steps. ☐

[a] Close the hood door. ☐

[b] IF the actuator cover can be moved freely,
THEN remove the actuator cover. ☐

[c] IF the cover is galled to actuator,
THEN leave the cap on the actuator
AND GO TO Step [1] [e] (in this Section 4.2, Removing the Actuator). ☐

[d] Install the shorting plug. ☐

[e] Position the reservoir on its side on the metal hood floor, so that the actuator and pit port(s) are pointing away from you. ☐

[f] Remove the actuator with pliers or wrench. ☐

[g] Place the actuator (with shorting plug, if installed) in aluminum foil and place it into the actuator disposal can. ☐

[h] Label the actuator disposal can with appropriate identification tags (Identification Tag Form 45). ☐

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4.2 Removing the Actuator (continued)

[2] Continue removing the actuators following Section 4.2, Removing the Actuators, step **[1]**, until all the reservoirs, with actuators, in the current batch have been done. ☐

[3] WHEN actuator removal from the current batch of reservoirs is completed, THEN seal the actuator disposal can with its top ☐

[4] Seal the actuator disposal can in a plastic bag for removal from hood. ☐

Health Physicist:

[5] Check the bagged actuator disposal can. ☐

[a] Verify that off-gassing and contamination are within limits (1500d/m and $1x10^{-5}$ microcuries/cc of air). ☐

[b] Mark verification on bag label, initial, and date. ☐

[6] IF the Health Physicist identifies that off-gassing or contamination exceed prescribed limits,
THEN STOP this procedure
AND contact supervisor immediately. ☐

[7] WHEN the Health Physicist has cleared the package for off-gassing and contamination,
THEN transfer the sealed can with the actuator(s) to Building 618 Squib room. ☐

Appendix B

5 WELD PREPARATION

NOTE *Vise grips, pliers, a file punch and a hammer are used to remove and/or open fill tube remnant.*

5.1 Preparing Reservoirs that have Stems that CAN be removed with Pliers

[1] Place the reservoir in the reservoir holding device. ☐

[2] Clamp the vise grips as close as possible to the base of the fill stem remnant. ☐

[3] Twist off the fill stem remnant. ☐

[4] IF the fill stem remnant cannot be removed by twisting with the vise grips, THEN GO TO Section 5.2, Preparing Reservoirs with a Stem that CANNOT be removed with Pliers. ☐

[5] Open up the fill hole for plug insertion by placing the punch in the fill hole and punching an indentation around the fill hole. ☐

[6] Remove the reservoir from the reservoir holding device. ☐

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5.2 Preparing Reservoirs with a Stem that CANNOT be removed with Pliers

[1] IF the reservoir has a wafer or stem that cannot be removed with pliers,
THEN perform the following steps: ☐

(A lengthy series of steps has been omitted here. The omitted steps provide no further exemplary guidance for producing a procedure)

6 PLUG WELDING

[1] Ensure that these parts are available for use:

A. one 0.275 inch electrode ☐

B. reservoir plug pieces (Part No. 14678), and ☐

C. an appropriate weld fixture (identified in Section 3.2) ☐

[2] Start up welder. ☐

[3] IF welding plugs for the first time this week,
OR an electrodes has just been changed
OR a fixture has just been changed,
THEN GO TO SOP-618-23, performing a test weld
AND RETURN TO this procedure, Section 6, PLUG WELDING step **[4]** ☐

[4] Move the reservoir to the plug welding station. ☐

[5] Obtain a clean conical plug piece (Part No. 14678). ☐

Appendix B

6 PLUG WELDING (continued)

[6] IF the plug piece is not clean,
THEN wipe the cone base off with an alcohol moistened cotton swab. ☐

[7] Visually verify that both the welder base plate and fixture surface are free of foreign materials. ☐

[8] Visually verify the plug and the weld area on the reservoir are clean. ☐

[9] IF the plug and weld area are not clean,
THEN clean with a cotton swab moistened with alcohol
AND purge area with dry nitrogen. ☐

NOTE *Section 3.2 of this procedure contains information on fixture numbers.*

[10] Install the reservoir in the appropriate fixture. ☐

[11] Apply <300 lb_f to the welder by backing the nitrogen regulator out until the heise gage reads zero. ☐

[12] Adjust the motion transducer to 0.4000 (acceptable range of 0.3995 - 0.4005) on the motion readout. ☐

[13] Apply 1000 lb_f (acceptable range of 9950 lb_f - 1050 lb_f) by opening the nitrogen pressure valve to the welder piston rams. ☐

Appendix B

6 PLUG WELDING (continued)

[14] Adjust the transducer bracket until the motion readout indicates 0.4000 (acceptable range of 0.3995 - 0.4005). ☐

[15] Verify "Flow Normal" indicator light on the control panel is on. ☐

NOTE *The low flow switch to the welder is pre-set to 0.75 gpm.*

[16] IF "Flow Normal" indicator light is not on,
THEN rotate the water filters to attempt to correct the flow conditions, ☐
AND verify that "Flow Normal" indicator light is on. ☐

[17] IF "Flow Normal" light is still not on,
THEN STOP this procedure, ☐
AND contact supervisor immediately. ☐

[18] Verify "Pressure Normal" indicator light on the control panel is on. ☐

[19] IF the "Pressure Normal" indicator light is not on,
THEN adjust the pressure switch located on the side of the welder head to a slightly lower setting ☐
AND verify the "Pressure Normal" indicator light is on. ☐

[20] IF "Pressure Normal" light is still not on,
THEN STOP this procedure, ☐
AND contact supervisor immediately. ☐

Appendix B

6 PLUG WELDING (continued)

[21] Verify "Resistance Normal" indicator light on the control panel is on. ☐

[22] IF the "Resistance Normal" indicator light is not on,
THEN check that the fixturing and items around the weld are not inhibiting current flow by insulating the fixture from the welder head or base. ☐
AND verify the Resistance Normal indicator light is on. ☐

[23] IF "Resistance Normal" light is still not on,
THEN STOP this procedure, ☐
AND contact supervisor immediately. ☐

NOTE *A low pitched buzz will indicate the weld occurred.*

[24] Switch the key operated weld selector switch on the control panel to WELD for 5 seconds, and then return the switch to OFF. ☐

[25] Record the post weld force, duffer current, and cycles on the Check Sheet/Data Sheet. ☐

Appendix B

6 PLUG WELDING (continued)

NOTE *The nominal values and the acceptable ranges are presented in the table in step **[26]**.*

[26] Verify readings are within the limits specified:

Parameter	No Tube	Step Stub Weld	
Current, amps	5000 (4500-5500)	4000 (3500-4500)	☐
Force, lb_f	1000 (950-1050)	1000 (950-1050)	☐
Cycles, Hz	25 (20-30)	25 (20-30)	☐

[a] IF the recorded readings are within the limits, THEN mark "YES" in the "Within Limits" column of the Check Sheet/Data Sheet ☐

[b] IF the recorded readings are not within the limits, THEN mark "NO" in the "Within Limits" column of the Check Sheet/Data Sheet ☐

[27] Switch station selector OFF. ☐

[28] Push emergency stop button to retract piston. ☐

[29] Remove reservoir from welder. ☐

Appendix B

6 PLUG WELDING (continued)

NOTE *Weld should have uniform runout of weld flash and no evidence of cracking in weld runout. Plug should be visually perpendicular to the reservoir.*

[30] Visually inspect weld for acceptability.

[a] IF the weld appears acceptable,
THEN mark "YES" in the "Visual Inspection Acceptable" column of the Check Sheet/Data Sheet ☐

[b] IF the weld appears unacceptable,
THEN mark "NO" in the "Visual Inspection Acceptable" column of the Check Sheet/Data Sheet ☐

[31] IF this is the first reservoir of the day,
OR the first reservoir after an electrode change,
OR the first reservoir after a fixture change,
THEN contact Health Physicist to check for off-gassing from plug. ☐

Health Physicist:

[a] Verify the off-gassing rate from the reservoir plug is less than 1.0×10^{-5} microcuries per cc of air. ☐

[b] IF the Health Physicist identifies that a reservoir exceeds the off-gassing rate limit,
THEN STOP this procedure, ☐
AND Contact supervisor immediately. ☐

Appendix B

6 PLUG WELDING (continued)

[32] Continue plug welding, following Section 6, Plug Welding, steps **[4]** through **[33]**, of this procedure until all the reservoirs in the current batch have been welded. ☐

[33] IF seal welding is completed for the day, THEN shutdown welder. ☐

7 DECONTAMINATION OF RESERVOIRS

(A lengthy series of steps has been omitted here. The omitted steps provide no further exemplary guidance for producing a procedure)

8 RESERVOIR STORAGE

(A lengthy series of steps has been omitted here. The omitted steps provide no further exemplary guidance for producing a procedure)

9 POST PERFORMANCE ACTIVITY

NOTE *This completed procedure is a record which is retained and dispositioned per the Records Inventory and Dispositioned Schedule.*

[1] Sign and date Check Sheet/Data Sheet. ☐

[2] Forward completed procedure to Building 618 clerk. ☐

APPENDIX A -- Check Sheet/Data Sheet

SERIAL NUMBER	TYPE RESERVOIR	RESERVOIR RECEIPT		WELD PARAMETERS					DECONTAMINATION		
		Unloaded	OK to Bury	Current	Force	Cycles	Within Limits	Visual Inspection Acceptable	Reservoir** Decon/Offgas Within Limits	HP Inspector's Initials/Date	Reservoir Stored in Cabinet

Operator's Initials____ Date____ Supervisor____ Date____	Operator's Initials____ Date____ Supervisor____ Date____	Operator's Initials____ Date____ Supervisor____ Date____

Note
* Record data in for weld parameters.
** Limits are 1500 d/m and 1 * 10^{-5} of microcuries/cc of air

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Appendix C: Glossary

acceptance criteria	Criteria that provide a basis for determining whether an activity has succeeded or failed. Acceptance criteria may be qualitative or quantitative.
actions	Specific action steps performed to accomplish a task.
action step	A procedure element that provides instruction for performing a specific action or task.
action substeps	Detailed actions that follow upper-level action steps. Performing all action substeps of an action step results in the action step being performed.
activities	Groups of related tasks performed to accomplish a goal.
appendix	Supplementary material at the end of a procedure. Appendixes include information more conveniently located after the main body of a procedure including forms, tables, figures and graphs.
approvals	Approvals are permission (OKs) from the responsible person(s) that an action or activity may take place. Approvals are usually obtained in written form, by signature or initials.
base procedure	The original procedure from which a user may be branched or referenced.
branching/branches	Branching routes the procedure user to other action steps or sections within the procedure or to other procedures and the user does not return to the original location.
caution	Cautions alert users to conditions, practices, or procedures that must be observed to avoid potential hazards involving products, equipment, and conditions adversely affecting site operations.
check	An action step that directs operators to see if a parameter has assumed a specified value or to see if a specific action has been carried out, and, if it has not, to take the next action specified (for example, notify supervisor).
check off	To check mark a box or line to indicate that the action step has been successfully accomplished.
concurrent action steps	Two or more action steps that are performed at the same time.
conditional action steps	An action step that is contingent upon certain conditions or combinations of conditions. Instructions performed if conditions warrant. Logic terms (for example, IF, AND, and THEN) are used to present conditional action steps.

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conditions of performance	The actual conditions under which the procedural activities are performed, including actual equipment location, lighting, ventilation, protective gear required, and temperature.
content	Subjects, topics, and technical information in a procedure.
contents	A listing of sections, subsections, appendixes that helps in locating those portions of the procedure.
continuous action steps	Action steps that apply for a period of time while the procedure is being executed.
coversheet	The first page of the procedure, which includes, as a minimum, the procedure title and page header.
data point	A discrete item of information. A data point is often quantitative but may be qualitative as well.
data recording	Writing down data points to obtain a written record of particular conditions at a given time. Data may be recorded for QA purposes or for use in further calculations or verifications.
decision tables	A format for presenting algorithms in tables.
equally acceptable action steps	Action steps that specify a number of equally acceptable alternative actions.
facing page	Either side of a two page spread of a procedure.
format	A plan or layout for the organization of pages in a document, including the size, style, typeface, margins, etc.
headings	Words or short phrases that introduce a section.
hold point	Hold points require users to wait until certain conditions exist or specific approvals or notifications have been made before continuing on in the procedure.
independent verification	Verification by someone other than the person who performed the task.

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level of detail	The level of technical detail presented in a procedure. Action steps that are written at a low level of detail include only general instructions and rely heavily on user training. Action steps that are written at a high level of detail precisely specify all actions.
logic term	One of the six words used in conditional action steps to structure the condition and relate it to the action: IF, WHEN, THEN, AND, OR, and NOT.
nonsequential action steps	Action steps that appear where they are first required but that may need to be performed later in the sequence of actions. Nonsequential action steps include continuous action steps, time-dependent action steps and repeated action steps.
note	Notes provide important supplemental information to users. This information is explanation, and contains no action or command.
notification	Notifications inform the appropriate personnel that an action or activity is about to occur or has already occurred.
page header	The page header appears at the top of every page and presents the procedure title, procedure number, revision number, revision date, and page number.
placekeeping	Placekeeping is used to assist the user in knowing what action steps have been accomplished in a procedure. Check off boxes are used to indicate that an action has been accomplished.
procedure	A procedure prescribes a process (a sequence of actions) to be performed to achieve a defined outcome.
referencing/references	Referencing instructions direct the users to temporarily abandon their place in the base procedure in order to perform action steps elsewhere in that procedure or in another procedure. When executing a reference, users always returns to the base procedure action step after performing the referenced action step(s).
repeated action steps	Action steps that are performed repeatedly at various times.

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revision log	The revision log identifies the revision history of the procedure and its effective date.
safety envelope	The safety envelope defines the conditions for which a nuclear facility has been designed, reviewed, evaluated, and determined to be capable of being safely operated. The safety envelope is determined by the facility design bases, design verification and functional test results, safety analyses, operating limits and surveillance requirements, and operating and maintenance procedures.
sign off	A sign off is a set of initials or a signature that indicates that the responsible person has successfully accomplished the action step. Sign offs may also be required of inspectors or other independent verification.
source requirements	Requirements implemented by the procedure.
table	Graphic representation of information where the items are placed in a matrix created by columns and rows.
task	A well-defined unit of work having an identifiable beginning and end which is a measurable component of the duties and responsibilities of a specific job.
task analysis	The systematic process of examining a task to identify skills, knowledge, and/or abilities required for successful task performance.
technical basis	The technical background and information, and the documentation of the background and information, needed as a basis for all technical content of a procedure.
technical procedure	Technical procedures prescribe production, operation of equipment and facilities, and maintenance activities. They do not include administrative nor emergency procedures.

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technical safety requirements (TSR)	Those requirements that define the conditions, safe boundaries, and the management or administrative controls necessary to ensure the safe operation of a nuclear facility and to reduce the potential risk to the public and facility workers from uncontrolled releases of radioactive materials or from radiation exposures due to inadvertent criticality. Technical Safety Requirements consist of safety limits, operating limits, surveillance requirements, administrative controls, use and application instructions, and the basis thereof.
time-dependent action steps	Action steps that impose time requirements on the user by specifying the duration of an action or actions that must be completed within a specific period of time.
user	The person(s) actually performing the procedure.
verb	The part of speech used to indicate an action or state of being.
verification	Verification involves action steps that direct users to see if a parameter has assumed a specified value or to see if a specific action has been carried out, and, if it has not, to take actions to make it so.
walkdown	A walkdown is that segment of a walkthrough which consists of physically visiting and observing the location in which the activities are to be performed and the equipment that will be used. A walkdown is performed to ensure that the equipment and environment are actually as envisioned and the people involved can perform the required tasks.
walkthrough	The walkthrough is the cumulative, detailed check of the process and facility. Activities that may be used to complete walkthroughs include walkdowns, simulations or modeling.
warning	Warnings alert users to conditions, practices, or procedures that must be observed to avoid loss of life or severe injury. Warnings alert users to potential hazards to personnel.

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Appendix D: Acronyms and Abbreviations

DOE	Department of Energy
IV	Independent Verification
M&TE	Measuring and Test Equipment
N/A	Not Applicable
QA	Quality Assurance
Rev	Revision
SAR	Safety Analysis Report
TSR	Technical Safety Requirements

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Appendix E: Action Verb List

The following list of verbs is not intended to be comprehensive. Verbs are selected from this list where possible so that words have a meaning common to all performers.

Avoid using terms that do not provide specific instructions unless they are followed by specifying information. For example, "increase" used without qualification is almost meaningless, but "increase flow to maintain level above the inlet standpipe" provides the necessary information.

Many of these verbs have similar meanings. Once a verb has been selected for a related series of action steps, use it consistently.

Developing and using a site- or facility-specific verb list is highly recommended. The site-specific verb list may drawn upon the following list of action verbs and may also use verbs that have specific meaning at the site. All verbs on the site-specific verb list should be defined precisely and used consistently in all site procedures.

VERB	DEFINITION (as used in Action Steps)
Actuate	Place into a specific state of functional performance.
Add	Increase the size or quantity.
Adjust	Make an incremental change or series of changes to arrive at a desired condition.
Align	Arrange equipment into a specific configuration to permit a specific operation.
Allow	Permit the completion of a specific action.
Announce	To make known publicly.
Assemble	Put together what is required to provide an operational or functional capability.
Attach	To fasten one thing to another.
Balance	Adjust several parameters at the same time at certain points in a system to specified values.

Appendix E

Barricade	To shut in or keep out with an obstruction.
Begin	Start an action or activity.
Bleed	Remove fluid from a piece of equipment at a restricted flow rate.
Block	Inhibit a capability of a specific system or piece of equipment.
Bolt	To attach or fasten with bolts.
Bypass	To circumvent a safety circuit (unless a single device provides for bypassing, such as a bypass switch, identify specific actions to bypass).
Calculate	To determine by computation (computation method should also be identified).
Change	To make different in some particular.
Charge	To load or fill (specific actions to charge should be included).
Check	Perform a comparison with stated requirements. No manipulation of equipment by the checker is involved.
Circle	To draw a circle around.
Clean	To rid of dirt, impurities, or extraneous matter.
Clear	To move people and/or objects away from.
Close	Manipulate a device to allow the flow of electricity or to prevent the flow of fluids, other materials, or light.
Collect	Cause the assembly of something in a fixed location or container.
Compare	Determine the relationship of the characteristics or values of different items, parameters, or conditions.
Complete	Fulfill or accomplish an instruction totally.

Appendix E

Consult	To ask for advice, to take counsel; to refer to.
Connect	Join, fasten, or fit to permit a desired capability
Continue	Maintain or resume the performance of an activity or condition.
Cool	Lower the temperature of equipment or an environment
Coordinate	Arrange for activity involving other personnel.
Correct	Alter to reestablish a desired activity or condition.
Count	To add together.
Cover	Protect or shelter equipment.
Cycle	Cause repetition of an action or activity.
Declare	To make known formally.
Decrease	Produce a smaller value.
Deenergize	Remove the supply of electrical power to equipment.
Depress	Manipulate to effect a specific position of a device.
Depressurize	To release gas or fluid pressure from.
Determine	To find out; to ascertain.
Discharge	To give outlet or vent to a fluid or other contents.
Disconnect	Separate or detach.
Discontinue	To cease to operate, administer, use, produce, or take.
Dispose	Remove from a specific location.
Don	To put on an article of wear.

Appendix E

Drain	Remove liquid from an enclosure or part of an enclosure, usually to empty.
Draw	To bring, take or pull out, as from a receptacle.
Energize	Provide equipment with electrical power.
Ensure	Confirm that an activity or condition has occurred in conformance with specified requirements (by action if necessary).
Enter	To make report of, set foot in.
Equalize	To make equal or uniform.
Establish	Bring about. Take necessary actions to cause a specified set of conditions to exist.
Estimate	Approximate the size, extent, or nature of a variable.
Evacuate	Vacate.
Evaluate	To assess; to determine the importance, size, or nature of; to appraise; to give a value to based on collected data.
Exit	To leave or withdraw.
Expedite	To accelerate the process or progress of.
Fill	Add fluid to a system or equipment to a prescribed point.
Filter	Pass fluid through a sized medium to stop the passage of unwanted material in the effluent.
Flush	Remove or clean with a washing action of a liquid.
Follow	Comply with an instruction.
Go to	Depart from a position in a procedure and resume at a different location in the procedure or in a different procedure.

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Ground	Provide an electrical path to a system at zero potential.
Guide	To manage or direct movement of.
Hold	Maintain a position for equipment, a place in a procedure, or an act of retention.
Identify	Determine or make known the parameter value or condition as related to a procedure.
Implement	To carry out; to accomplish.
Increase	Produce a larger value.
Indicate	Make known an activity, parameter value, or condition.
Inflate	To blow full with air or gas.
Inform	To communicate knowledge.
Initiate	To begin a process, usually involving several action steps or actions.
Inject	To introduce a new element; to drive a fluid.
Insert	Place or position into; move control rods into the reactor core.
Inspect	To examine; to perform a critical visual observation or check for specific conditions; to test the condition of.
Install	Fix or fit into equipment or a system.
Instruct	Direct or command.
Interchange	To substitute two items, one for another.
Investigate	To search or inquire into.
Isolate	To shut off or remove from service.

Appendix E

Jumper	To make a connection between two circuit points not normally connected.
Label	To mark or identify.
Latch	To close or fasten.
Lift	Elevate to a higher level or remove, as in removing electrical leads or restrictions.
Limit	Restrict or impose bounds.
Locate	Determine or establish place or position.
Lock	Securely fasten, to prevent capability to function.
Log	To enter into a record of operations or progress.
Lower	Cause to move down or decrease position or value.
Lubricate	To apply a lubricant to.
Maintain	To hold or keep in any particular state or condition, especially in a state of efficiency or validity.
Minimize	To reduce to the smallest amount or degree.
Mix	Intermingle ingredients uniformly.
Monitor	Observe an activity, parameter value, or condition (usually on a continuous basis) to meet an instruction requirement.
Notify	Contact, advise, or communicate to make someone aware of an impending or completed activity, parameter value, or condition.
Observe	To watch carefully.
Obtain	To get or attain.

Appendix E

Open	Manipulate a device to prevent the flow of electricity or to allow the flow of fluids, other materials, or light.
Operate	Cause equipment or system to perform designed functions.
Pass	To go by; move by.
Perform	Carry out specified actions or action steps.
Place	To put or set in a desired location or position.
Plot	To represent graphically.
Plug	To connect or become connected, as in electrical plug; to stop or insert something.
Press	To act upon through thrusting force exerted in contact; to push.
Pressurize	To apply pressure within by filling with gas or liquid.
Prevent	To keep from happening.
Proceed	To go on in an orderly, regulated way.
Pull	To exert force upon so as to cause or tend to cause motion toward the force.
Purge	To make free of unwanted substance such as an impurity or foreign material.
Push	To press against.
Pump	Move a fluid in a piping system by the use of suction, pressure, or both.
Rack in	Insert a circuit breaker into its operating position.
Rack out	Withdraw a circuit breaker into its nonoperating position.
Raise	Cause to move up, or increase position or value.
Read	Obtain information visually.

Appendix E

Recirculate	Cause repetitive motion of a fluid in a system.
Reduce	Decrease a variable to meet a procedure requirement.
Refer to	Use specified information that is in another location or procedure.
Release	To set free from restraint or confinement.
Remove	To take off, move away, or eliminate.
Repair	To restore to a sound state.
Repeat	Do again.
Replace	Install an equivalent part or component.
Request	Ask.
Reset	Reestablish a piece of equipment, part, or component to a previous condition, parameter value, instrument set point, or mechanical position.
Resume	To begin again after cessation or interruption.
Return to	To go back to a previous action step in the procedure in effect.
Review	Examine with deliberation for confirmation or compliance to an instruction.
Rotate	Cause to turn on an axis.
Sample	Take a representative portion for the purpose of examination.
Secure	Fasten or make safe.
Select	To take by preference of fitness from a number or group; to pick out; to choose.
Send	Dispatch.
Separate	Move apart or detach.

Appendix E

Set	Adjust equipment to a specified value
Shake	To agitate.
Shut down	Remove from operational status.
Silence	To stop from making noise.
Sound	To order, signal, or indicate by a sound.
Stabilize	To become stable, firm, steady.
Start	Originate the motion or function of an electrical or mechanical device.
Station	To assign a person to stand and remain at a certain place.
Stop	To halt movement or progress; to hold back; to halt.
Store	To place in reserve, to hold for later use.
Stroke	Operate a valve over its full travel. The travel time may be measured.
Subtract	To perform a subtraction.
Tag	Identify with a prescribed label.
Throttle	Adjust a valve to an intermediate position to obtain a desired parameter value.
Torque	To cause to twist or turn, as about an axis.
Transfer	To cause to pass from one to another.
Transport	To transfer or convey from one place to anther.
Trip	To manually activate a semiautomatic feature; to cause to fail or stop.
Turn	Adjust with a force on an actuator that positions form a circular movement.

Appendix E

Unlock	To unfasten the lock of.
Unplug	To remove from a socket or receptacle.
Update	To revise to include latest information or data.
Use	To avail oneself of; to employ; to utilize.
Vent	Release a gas or liquid confined under pressure.
Verify	Confirm, substantiate, and assure that a specific activity has occurred or that a stated condition exists.
Walk	To move along on foot.
Weigh	To measure the heaviness of as by a scale.
Withdraw	To remove.
Work	To perform a task.

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CONCLUDING MATERIAL

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MMES, Portsmouth; LANL; Battelle, PNL

Preparing Activity:
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Headquarters Offices:
AD, DP, EH, EM, ER, GC,
IG, NE, NS, RW

Project Number:
HFAC-0009

Field Offices:
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RF, SR, SF

TS

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DOE-STD-1030-96
May 1996

Supercedes
DOE-STD-1030-92

DOE STANDARD

GUIDE TO GOOD PRACTICES FOR LOCKOUTS AND TAGOUTS

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

AREA SAFT

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, "Conduct of Operations Requirements for DOE Facilities."

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(SAMPLE) LOCKOUT/TAGOUT RECORD SHEET A-1

ACRONYMS

CFR	Code of Federal Regulations
OSHA	Occupational Safety and Health Administration

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DEFINITIONS

Affected Person	Person whose job requires operation or use of equipment on which maintenance is being performed under lockout/-tagout, or whose job requires work in an area in which such maintenance is being performed.
Authorized Person	Person qualified through system knowledge and lockout/-tagout training, and authorized by the facility to install lockout/tagout on machines or equipment in accordance with facility procedures.
Capable of Being Locked Out	An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.
Caution Tags	Tags used to indicate some precaution or item of information that must be known prior to operating a component or system. Caution tags may be used on functional components or systems. Caution tags are NOT to be used for energy isolation (i.e., do not use caution tags where it is appropriate to use lockout/-tagout).
Centrally Controlled Lockout/Tagout	A lockout/tagout in a facility having a central organization that is responsible for operation of the facility or process and is separate from maintenance organizations. In such facilities, all lockouts/tagouts are authorized by the operations supervisor and all lockout/-tagout activities are coordinated by operations personnel. Compare "Individual-Controlled Lockout/Tagout."

Contractor	A person, consultant, partnership, or corporation providing assistance in the management, operation, testing, inspection, or servicing of equipment at a DOE facility.
Controlled Document / Controlled Drawing	A document or drawing whose content is maintained uniform among all copies by an administrative control system.
Energy Source	Any source that could cause harm to personnel or equipment by generating or transferring electrical energy or potential (voltage); hydraulic, pneumatic, gas, or steam pressure; vacuum; high temperature; cryogenic temperature; potentially reactive chemicals; or stored mechanical energy.
Energy-Isolating Device	A mechanical device that prevents the transmission or release of energy. Examples include: a circuit breaker, a disconnect switch, a flow control valve, a slide gate, a blind flange, a block, and any similar device used to block or isolate energy. Push buttons, selector switches, or other control-circuit-type devices are not considered energy isolating devices.
Hazardous Substance or Material	Any solid, liquid, or gaseous material that is toxic, explosive, flammable, corrosive, or otherwise physically or biologically threatening to health. Oil is excluded from this definition.
Individual-Controlled Lockout/Tagout	A lockout/tagout in a facility wherein individual operators are responsible for operating and maintaining individual machines or processes. In such facilities, lockout/tagout is performed by each individual requiring protection. Compare "Centrally Controlled Lockout/Tagout."

Installation of Lockout/Tagout	The process of positioning energy-isolating devices, attaching locking devices (if applicable), and attaching tagout devices.
Lockout	The placement of a lockout device on an energy-isolating device, thereby preventing the energy-isolating device and the equipment being controlled from being operated until the lockout device is removed.
Lockout Devices	Devices that use a positive means, such as a combination or key lock (key locks are preferred), to hold an energy-isolating device in the safe position and prevent the energizing of equipment. Hasps, chains, and other devices may be treated as lockout devices when used in conjunction with locks.
Lockout/Tagout	A general term for all methods of ensuring the protection of personnel and equipment by installing tagout devices, with or without lockout devices.
Lockout/Tagout Holder	A qualified individual who is authorized to work, or to supervise work, under a centrally-controlled lockout/-tagout. A lockout/tagout holder is the same as "the authorized employee who is responsible for (that is, being protected by) the lockout or tagout device" or "the employee in charge of the clearance" as designated by OSHA.
Maintenance	Any activity involving work on the equipment to improve or retain its capability to function in the system, including maintenance or service, inspection, testing, and calibration.
Release of Lockout/Tagout	Formal termination of the need for protection under a lockout/tagout, by the protected individual.

Removal of Lockout/Tagout	Physical removal of the tags and locks associated with a lockout/tagout and, if not prevented by another active lockout/tagout, restoring the equipment to operable status.
Responsible Supervisor or Manager	The individual having authority and responsibility for operational control of a facility, process, experiment, or other project.
Tagout	The placement of tagout devices on energy-isolating devices to inform personnel that the energy-isolating device and the equipment being controlled MUST NOT be operated.
Tagout Device	A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled MUST NOT be operated or removed. Tagout devices are installed with all lockout devices, and on all boundary points that isolate equipment from sources of energy. Tagout devices are also installed on components used to verify or enhance the safety of a lockout/tagout, such as opened valves for venting and draining, installed grounds, or monitoring instrumentation.

GUIDE TO GOOD PRACTICES FOR LOCKOUT AND TAGOUT

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Lockouts and Tagouts, Chapter IX of Department of Energy (DOE) Order 5480.19, "Conduct of Operations Requirements for DOE Facilities." The practices in this guide should be considered when planning or reviewing lockout and tagout programs. Employers at DOE facilities are advised to adopt procedures that meet the intent of 29 CFR (Code of Federal Regulations), Parts 1910 and 1926 (OSHA) and DOE Order 5480.19.

DOE Order 5480.19 and this Guide to Good Practices provide a set of guidelines and good practices for lockout/tagout from an operational standpoint. However, employers should be aware that there are further details in other sources (e.g., OSHA) which deal more specifically to lockout/tagout requirements from a personal safety standpoint. Employers should refer to these other sources for additional insights to requirements and good practices for the implementation of lockout and tagout programs at their facilities. If conflicts arise between OSHA and DOE Order 5480.19 or this Guide, OSHA shall take precedence.

Public Law 91-596, dated December 29, 1970, established OSHA, which had as its main purpose to ensure "so far as possible every working man and woman in the Nation safe and healthful working conditions." As part of this effort in the late 1980s, OSHA reviewed materials from many different sources to gather information on accidents that were caused by failure to properly lockout and tagout hazardous energy sources. As a result of the reviews, OSHA began to establish standards dealing with lockout/tagout of hazardous energy sources.

The first standard became effective in January 1990. Standard 29 CFR 1910.147, "The control of hazardous energy (lockout/tagout)," deals with servicing and maintenance of machinery and equipment. This standard was followed in December 1990 by 29 CFR 1910.333, "Safety-Related Work Practices," which addresses exposure to electrical hazards from work on, near, or with conductors. In May 1994, 29 CFR 1910.269, "Electric power generation, transmission, and distribution," became effective and established locking and tagging procedures for the deenergization of electric energy sources used for purposes of generation, transmission, and distribution, as well as equivalent installations of industrial

establishments. In addition, 29 CFR 1926.417, "Lockout and Tagging of circuits," was established to cover construction activities.

The primary purpose of all four of these lockout/tagout programs is to protect employees from exposure to potential hazardous energy sources. In fact, OSHA estimates that proper implementation of these standards will prevent approximately 261 deaths annually and will reduce the average injury and lost work days associated with lockout/tagout injuries by 85 percent annually.

"Lockout and Tagout" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the need for a formal lockout and tagout program to promote safe and efficient operations.

2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

A lockout/tagout program is implemented to provide protection to personnel and equipment, and to aid in the control of equipment and system status.

Criteria:

1. Locks and tags are used when controls must be established to protect personnel, equipment, or the environment.

2. The facility lockout/tagout program is implemented through physical and administrative controls on sources of energy and hazardous materials.

3. Protective materials and hardware are provided to control sources of energy and hazardous material.

4. Procedures are developed and used to control and document the application of lockouts/ tagouts.

5. Lockout/tagout procedures provide instruction for all aspects of energy control including notifications, equipment shutdown, isolation, application of locks and tags, verification, release, removal, and restoration to operational status.

6. Requirements are specified for temporary or partial removal of a lockout/tagout for testing or equipment positioning.

7. Periodic inspection and review of lockout/tagout implementation are performed.

8. All personnel receive appropriate training in the safe application, use, and removal of lockouts/tagouts.

9. The lockout/tagout program specifies actions that must be taken when other than facility personnel (e.g., vendors, subcontractors, etc.) perform work on equipment.

10. The lockout/tagout program identifies any special requirements for maintenance

performed under a group lockout/tagout.

11. The lockout/tagout program identifies the requirements for transfer of lockout/tagout at shift change.

12. Caution tags are controlled similarly to tagout devices but are not used for energy isolation.

3. DISCUSSION

A program for lockout and/or tagout (hereafter referred to as lockout/tagout) is of primary importance for ensuring worker safety in DOE facilities. The overall program for safety at DOE facilities is described in guidelines published by the Department of Energy, Office of Environment, Safety, and Health. Lockout/tagout is an essential part of this overall safety program.

A lockout/tagout program is designed to identify sources of energy and hazardous materials that could adversely affect maintenance activities, isolate all such sources from the work area, and ensure that the isolation remains effective until the work is completed. Lockout/tagout should be applied whenever workers are performing maintenance on facility equipment or systems where there is any possibility of injury or damage as a result of release of energy or hazardous materials.

If a facility's lockout/tagout program is to be effective, it must be understood by all affected personnel; it must be applied uniformly in every job; and it must be respected by every worker and supervisor. The requirements for lockout/tagout in U.S. industry are identified in OSHA regulations.

The lockout/tagout procedures in many DOE facilities, like the procedures used in electric utility power plants, must apply to situations requiring special control measures. In these facilities, measures to protect the individual worker must be integrated with the operation of larger safety systems designed to protect the public, the environment, and the facility. The procedures used in these facilities address protecting personnel from injuries resulting from unexpected operation or energizing of equipment. They also address preventing the unexpected or inadvertent loss of essential safety systems and operating facility systems.

Operation of equipment in these facilities is usually performed by an operations organization. Qualifications for operations personnel are distinct from the qualifications of maintenance or other service personnel. The specialized knowledge operators must possess regarding system functions and interactions mandates that only qualified operators may manipulate facility controls for any purpose, including lockout/tagout.

Within this Guide to Good Practices, two methods of lockout/tagout implementation are discussed. For facilities or situations where the application of lockout/tagout is limited and has no effect on the overall facility safety or environmental systems, the method is called an individual-controlled lockout/tagout. For facilities where the application of a lockout/tagout

is far-reaching and may alter an integrated process, the method is called centrally controlled lockout/tagout. For example, centralized operations control (similar to electric utilities) or situations requiring integration of lockout/tagout with other functions would use a centrally controlled lockout/tagout. This guide identifies many lockout/tagout practices that apply to both methods. It also identifies many additional or alternative practices that apply to only one method. DOE facilities may have operating characteristics addressed by either method. As part of the implementation of a lockout/ tagout program, each facility must determine which guidelines are most applicable to the facility's own function and organization. The goal of the lockout/tagout program is the same for all DOE facilities: the control of potentially hazardous energy sources and hazardous materials to ensure safety.

4. GOOD PRACTICES

4.1 Lockout/Tagout Use

Lockout/tagout in a DOE facility may serve three functions. The first function, defined by both OSHA and DOE Order 5480.19, is to protect personnel from injury. The second function closely related to that, is to protect systems and equipment from damage.

The third function of lockout/tagout is part of the overall control of equipment and system status. A properly performed lockout/tagout ensures that the operating staff is aware that the affected equipment cannot be operated. Coordination of lockout/tagout with the operating staff helps ensure that necessary operations and safety functions can be performed without exceeding the approved operating criteria for facility systems or causing unexpected hazardous releases to the environment.

Both functions are necessary for the overall safe operation of DOE facilities, in accordance with guidelines published by the Department of Energy, Office of Environment, Safety, and Health. Some considerations affecting the use of lockout/tagout are identified in the following sections.

4.1.1 Protecting Personnel from Injury

The primary emphasis of the lockout/tagout program is to protect personnel from injury. Lockout/tagout is required when maintenance is to be performed on equipment, unless the criteria listed in Section 4.1.4 of this document are met to qualify for exception to the lockout/tagout program. After the equipment has been isolated from all sources of potentially hazardous energy and material, locks (if used) and tags are applied to the isolating devices to ensure that the equipment cannot be operated inadvertently.

4.1.2 Protecting Equipment from Damage

When equipment problems that could destroy or severely damage the equipment are detected, a lockout/tagout may be used to remove the equipment from service and prevent its operation until corrective maintenance can be performed. If lockout/tagout is used to protect the equipment, the procedures are identical to those used when the purpose is to prevent personnel injury – first, isolate the

equipment from all sources of potentially hazardous energy, then apply locks and tags to prevent accidental or inadvertent operation.

In some facilities an alternative system is used for equipment protection. In this system, the equipment is not physically isolated from all energy sources but rather is tagged to indicate the specific conditions under which operation may be permitted. This system uses caution tags, which are discussed in Section 4.11. The use of caution tags is not permitted as a lockout/tagout to protect personnel from energy or hazardous material sources.

4.1.3 Other Uses of Lockout/Tagout

In some situations, it may be necessary to prevent inadvertent operation of a functional system. The following example illustrates this:

> Fresh nuclear fuel for a particular reactor must be kept dry (free from water) until it is ready to be loaded into the reactor. This is necessary to prevent the possibility of an inadvertent criticality. When fuel is received in the facility, it must be transported through an area where a fire-protection sprinkler system is installed. During the time nuclear fuel is present in the area, it may be appropriate to isolate, lock, and tag the fire-protection sprinkler system to prevent its operation.

In this case, the lockout/tagout is not related to any maintenance activity, but the situation requires that the system be inoperable for safety reasons. Locking out valves on storage tanks to prevent environmental impact during maintenance may also be an appropriate use of lockout/tagout.

4.1.4 Exceptions to Lockout/Tagout Requirements

OSHA does not require lockout/tagout for activities that are performed as part of normal operations, such as minor tool changes and adjustments, as long as effective alternate protective measures are used. Lockout/tagout is also not applicable to hot tap operations involving work on pressurized transmission and distribution pipelines for gas, steam, water, or petroleum products; however hot taps should be used only when continuity of service is essential, and procedures and equipment that provide proven effective protection for personnel are used.

Equipment that presents no danger to personnel or other equipment during maintenance does not require lockout/tagout. For example, electrical equipment whose maximum voltage is less than 30 volts will not normally require lockout/-tagout if there will be no increased exposure to electrical burns or to explosion due to electric arcs. Equipment that can be deenergized by unplugging it from its energy source does not require lockout/tagout, if the unplugged power cord is under the exclusive control of the person performing the maintenance. Lockout/tagout is required for all other equipment.

OSHA requirements identify specific situations where the use of a written procedure for lockout/tagout is not necessary. An authorized individual can perform lockout/ tagout without a written procedure if ALL the following criteria are met:

- The machine or equipment has no potential for stored or residual energy or reaccumulation of stored energy that could endanger personnel after shutdown

- The machine or equipment has a single energy source that can be readily identified and isolated

- The isolation and locking/tagging of that energy source will completely deenergize and deactivate the machine or equipment

- The machine or equipment is isolated from that energy source and locked out during maintenance

- A single lockout device will achieve a locked out condition

- The lockout device is under the exclusive control of the authorized personnel performing maintenance

- The maintenance does not create hazards to other personnel

- There have been no accidents involving unexpected activation or reenergizing of the machine or equipment during previous maintenance.

4.2 Lockout/Tagout Implementation

Before implementing a lockout/tagout program, it is necessary to identify the method of equipment control used within the facility. There are two approaches to equipment control, individual-controlled and centrally controlled.

4.2.1 Individual-Controlled Lockout/Tagout

In some DOE facilities, individual workers operate equipment for the purpose of producing, assembling, testing, or packaging components or products. The equipment used may include milling machines, lathes, presses, test benches, and other machines. Each worker may be responsible for operation and routine maintenance of an individual piece of equipment.

For these workers, protection from hazardous energy sources simply means preventing the power from being inadvertently or accidentally turned on while they are performing the maintenance. The simplest and most effective method for controlling the hazardous energy is the individual-controlled lockout/tagout.

Under an individual-controlled lockout/tagout, the individual worker is responsible for taking all necessary actions to ensure personal safety and the safety of others during the maintenance. To aid the worker, OSHA and DOE Order 5480.19 require the following:

- Locks will be used whenever possible to secure energy or hazardous material isolating devices. New equipment and major equipment modifications will be designed to permit the use of locks. Tags should be used to identify the person who placed the lock and the purpose of the lock. If locks cannot be used, installation of tagout devices is required.

- Management should identify activities that require lockout/tagout. For each activity requiring lockout/tagout, criteria should be provided to identify the locations for locks and tags.

- Only designated personnel should have access to keys for keylocks that are integral to control devices. If the worker deactivates equipment by removing the key from the control switch, it is essential to ensure that no additional keys are available to unauthorized personnel. Additionally, the control switch should be tagged.

- Every isolation from an energy or hazardous material source must be verified. Specific techniques for verification should be established by facility procedures. The initial verification should include a review of pertinent controlled drawings or manuals, and a hands-on physical check of the equipment. The drawings should be used to help identify the sometimes obscure sources of power or pressure (e.g., control power, indication or interlock circuits, sensing lines) that may be present in equipment even though the main (and obvious) sources have been isolated. If a physical check is not possible because of hazards in the area or an existing lockout/-tagout, other verification, such as observation of a reliable position indicator, is required. Periodic checks should be performed to ensure that isolating components remain in the proper position and that locking devices remain properly attached.

- If it is necessary to unlock an isolating device or place it in a position other than the prescribed position during maintenance, specific authorization should be obtained and documented. Before the change is made, persons who will perform maintenance while the deviation is in effect must clearly understand the change in protection level and any additional restrictions necessary to ensure safety.

4.2.2 Centrally Controlled Lockout/Tagout

In contrast to the facilities described in Section 4.2.1, other DOE facilities have a central organization that is responsible for operation of the facility or process, or interrelated systems that are not necessarily under a single individual's control. The facility may contain highly complex specialized equipment, such as a reactor or a particle accelerator, or it may contain equipment spread over a large area, such as electrical distribution systems. In facilities like these, certain process and specialized safety functions may be required to ensure the safety of personnel, equipment, and the environment, even though maintenance is being performed on other parts of the system.

In these facilities, lockout/tagout is more clearly a part of the overall program for control of equipment and system status, and therefore must involve operations personnel and supervision in the approval and implementation process. Maintenance personnel are not normally trained in the requirements for safe operation of the process systems, therefore maintenance personnel are not normally authorized to operate facility equipment, except within the requirements of specific maintenance procedures.

Lockout/tagout in centrally controlled facilities requires effective coordination between operations and the personnel performing maintenance to ensure that appropriate safety functions are maintained and that a safe work environment is provided. Coordination is also required when a lockout/tagout in one facility could affect systems or site utilities in another facility. Therefore, operations managers should define system and process boundaries.

In some cases, operations may define equipment that can be turned over to maintenance for all work-related activities, including lockout/tagout control. In these cases maintenance must comply with all lockout/tagout requirements, including documentation and restoring the equipment to operable condition. Whether the lockout/tagout is performed by operations or maintenance personnel, the process for approval and centralized control should be the same.

Many of the requirements for a centrally controlled lockout/tagout are similar to those for an individual-controlled lockout/tagout. Requirements of both programs are described in the following sections.

4.2.3 Lockout/Tagout Practices

Anyone involved with the lockout/tagout process, including preparing, placing, verifying, or accepting a lockout/tagout must be aware of the requirements for safely isolating hazardous energy or material sources (e.g., electrical circuits, fluid lines, capacitors, material storage tanks). The following standard practices should be supplemented by specific practices applicable to facility systems.

4.2.3.1 General Practices

A lockout/tagout must isolate <u>all</u> sources of energy or hazardous materials that may cause personnel injury or equipment damage. For

example, isolating a pump motor for bearing maintenance should also include shutting and tagging the pump suction and discharge valves to prevent possible rotation from fluid flow.

Only controlled drawings, controlled system schematics, or other controlled documents should be used as references for determining or verifying isolation points. In the absence of controlled drawings, a physical walkdown should be performed by a qualified person to ensure that isolation will be achieved by the planned lockout/tagout.

Operation or removal of tagged-out equipment is NEVER permitted. Removal of tagged-out equipment would be impossible unless new isolation boundaries have been established and the tagged-out component is now itself isolated. In that case, any affected lockout/tagout should be modified to reflect the new isolation boundaries. The obsolete tag(s) should be removed in accordance with established procedures before starting maintenance activities.

Some control devices "seal in" when actuated and could cause equipment to start when power is restored. Because of this component trait, the practice of verifying lockout/tagout isolation by operating the controls (e.g., pressing the start button) for the affected equipment should not be permitted.

Control switches should be tagged in a position corresponding to the desired protective state of the equipment (e.g., OFF, neutral, pull-to-lock), even when another device (e.g., circuit breaker, disconnect switch, valve in pneumatic supply line) provides the primary isolation from the energy source.

4.2.3.2 Electrical Practices

If electrical grounding devices are required, the location and sequence for installation of each device should be specified in the lockout/tagout procedure.

All electrical grounding devices used in a lockout/tagout should be tagged out to ensure that the grounds remain in place until the work is

complete, and that they are removed before reenergizing the system.

4.2.3.3 Piping Systems Practices

Systems, portions of systems, and components that operate at temperatures or pressures above ambient should be vented and, if necessary for the performance of work, drained or cooled. Whenever possible, an atmospheric drain and/or vent between the component to be worked and sources of pressure to the component should be tagged in the open position to depressurize the equipment and to accommodate thermal expansion or contraction.

Systems that operate at high temperatures (e.g., greater than 200°F for a water system) or high pressures (e.g., greater than 500 psig), should be isolated from the work area by two closed valves in series, and a telltale vent or drain valve between the isolation valves should be opened. Systems containing hazardous materials should be isolated by two valves in series and the isolated section should be purged. When any of these conditions exists and two-valve isolation cannot be provided, specific management approval should be obtained before performing work. Exceptions to the two-valve isolation should be documented in the lockout/tagout record and in the work package, and the workers should be informed.

Verifying depressurization by breaking flanged connections, loosening valve bonnets, removing instrument tubing, or other similar actions should be avoided unless no other means for verifying depressurization exists. Strict supervisory control and advance planning are required if these methods are used.

4.2.3.4 Valve Practices

Pneumatically operated valves and solenoid-operated valves may be used as isolation points if the following conditions are met:

- A pneumatically or solenoid-operated valve that fails open is NOT considered closed for lockout/tagout purposes, unless its power (air) supply is isolated and the valve is forcibly closed with an

installed jacking device or gag (i.e., a device designed to block off or obstruct operation of a valve). The valve and its power (air) supply isolation points must be tagged.

- A pneumatically or solenoid-operated valve that fails closed is NOT considered closed for lockout/tagout purposes unless its power (air) supply is isolated and the valve is visually confirmed to be closed. The valve and its power (air) supply isolation points must be tagged.

A pressure operated valve or check valve CANNOT be used as an isolation boundary valve unless it is physically restrained in the required position by a gagging device approved by the facility.

A motor operated valve may be used as an isolation boundary point provided that, after the valve has been positioned as required by the lockout/tagout, its power supply is isolated and tagged.

The local control point (e.g., handwheel, manual operator) for a motor or pneumatically operated valve must be locked/tagged when the valve is used as an isolation boundary point. Any remote control points (e.g., control switches, reach rods) should also be tagged

4.2.3.5 Practices for Injecting Energy Potentials Into Systems and Components for Testing

Lockouts/tagouts that are established to isolate a component, portion of a piping system, or electrical circuit for the purpose of injecting an energy potential for testing (e.g., hydrostatic test, local leak-rate test, electrical insulation test, etc.) within the lockout/tagout boundary require special consideration.

The lockout/tagout should be prepared in accordance with an approved written procedure that specifically addresses the conduct of the test.

The initial lockout/tagout boundaries should be established to protect test personnel and test equipment while test equipment is being connected to the system or component. Other work within the area isolated for

testing should be suspended.

After the test equipment is installed, an isolation boundary must be established to confine the testing activity and to protect equipment and personnel outside the boundary while testing is in progress. The initial lockout/tagout boundary may be used for this purpose but must be carefully evaluated to ensure adequate protection for equipment and components outside the isolation points.

4.3 Protective Materials and Hardware

Both DOE Order 5480.19 and OSHA include specific requirements for isolation devices, locking devices, and tags. This section offers some explanation related to those requirements.

All locking devices and other protective materials must be standardized and issued by the employer (facility). These requirements are important for two reasons. First, it would be impossible to maintain control and accountability if each worker used locks or other devices that were not standardized or did not offer adequate protection. Second, it is essential that locking devices and tags be readily identifiable and not used for any other purpose.

Locking devices and tags must be standardized either in color, shape, or size. For example, if a facility has decided to use commercial 1-inch padlocks with a red plastic band for lockouts, every lock used on a lockout will be immediately recognizable by those characteristics. Similar 1-inch locks with red plastic bands would not be permitted in any other use, such as securing a locker. Tags require a standard print and lettering format, in addition to standard color, shape, or size.

Locking devices and tags must be durable enough to withstand exposure to the environment where they are installed, for as long as they are expected to be there. This means that the tag must not deteriorate and the message must remain legible. Tags placed in areas where acids or caustics are used or stored may require clear plastic covers or lamination to meet this requirement.

Locking devices must be substantial so they cannot be removed or bypassed while workers are depending on them for protection.

Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and shall have the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

All locking devices and tags used in individual-controlled lockouts/tagouts must identify the person applying them and the organization. This requirement can be met by always tagging each lockout device, and always identifying the individual and organization on each tag. In centrally controlled lockouts/tagouts, the tag should be uniquely identified (numbered), should identify the component and the required position, and should identify the persons placing and verifying the tag.

Tagout devices must clearly warn that operation is not permitted (for example, "Danger, Do Not Operate"). These tagout devices should never be used on equipment that is energized or in-service.

4.4 Procedures for Lockout/Tagout

Facilities are required to use administrative procedures to ensure uniformity in applying their lockout/tagout program. In addition, each lockout/tagout, unless exempted in accordance with Section 4.1.4 of this guide, requires a specific written technical procedure in which the isolation points and other instructions for installing and removing tags are identified. The technical procedures containing lockout/tagout instructions can be developed in any one of the following three ways:

- Maintenance procedures may identify the isolation and tag locations required for a job or for a piece of equipment. In centrally controlled facilities, development of these procedures should involve operations personnel to ensure that the protection is adequate and that other systems or equipment are not inadvertently affected.

- Operating procedures may be prepared and approved in advance for isolation of specific systems or equipment.

- Lockout/tagout instructions may be prepared and approved by the responsible supervisor or manager to meet a specific work requirement.

A generic procedure for similar types or like pieces of equipment can be used as a technical procedure.

4.4.1 Requirements for Lockout/Tagout Procedures

Each of the technical lockout/tagout procedures should:

- Identify the intended use of the procedure and any limitations or restrictions controlling its use.

- Specify the procedural steps necessary to isolate the work area from all sources of energy or hazardous materials. The procedure should identify the locations for all tags, the order of operation and tagging, and the final position of tagged components.

- Provide specific instructions for placing and removing locks and tags, and for documenting the placement and removal of each lock and tag. If the work is expected to continue beyond a single shift, instructions should also be provided for transfer of "ownership" or protection.
- Provide clear instructions for verifying the effectiveness of the lockout/-tagout. The verification should be performed by qualified personnel who were not involved in isolating the work area or installing the locks and tags. *DOE Guide to Good Practices for Independent Verification* can provide useful guidelines for carrying out an independent verification of a lockout/-tagout.

4.4.2 Documentation of Lockout/Tagout

Each lockout/tagout should be documented based upon facility risk and operational requirements. Documentation for a simple individual-controlled lockout/tagout may consist of a record on the completed tag. A lockout/tagout that involves multiple energy-isolating devices, or that will be used by several individuals or work groups (including centrally controlled lockout/tagout) should document the following activities as they apply: authorization, placement of locks and tags, verification of effectiveness, acceptance by individual workers or work group representatives, release by workers at the completion of the job, authorization for and removal of locks and tags, and restoration to operable condition.

The sample Lockout/Tagout Record Sheet in Appendix A provides one approach to documenting a lockout/tagout.

Facilities also may use a standardized form, such as the sample Lockout/Tagout Record Sheet, when it is necessary to prepare and approve lockout/tagout instructions to meet a specific work requirement. When completed, the form should provide the necessary procedural steps for isolation, specific instructions for placing and removing locks and tags, and instructions for verifying the effectiveness of the protection.

4.5 Installing, Verifying, and Removing Lockout/Tagout

Certain elements of a lockout/tagout should be performed in sequence to ensure that the lockout/tagout provides the desired level of safety. Understanding these elements will help facilities define the specific steps that will be required in the installation, verification, and removal of facility lockouts/tagouts. The operating principles that form the basis for these elements are discussed below.

4.5.1 Installation of Lockout/Tagout

Lockout/tagout should not be installed unless authorization has been obtained from the supervisor responsible for operation and status of the equipment. In addition, the following guidelines should be observed.

- Only personnel who are qualified and authorized should be permitted to isolate equipment or install locks and tags. This is necessary to ensure that the operator responsible for the equipment or process is aware of its status and is able to verify all requirements for personnel and equipment safety. It also helps ensure that adequate protection is provided to the worker, even when the worker is not familiar with system operation.

  In facilities using individual-controlled lockout/tagout, a qualified operator should assist anyone needing protection (e.g., vendor) who is unfamiliar with the isolation procedure. When the lockout/tagout is installed, it should be placed under the control of the person requiring the protection.

- All personnel authorized to isolate equipment or install locks and tags should

know, through training and qualification, the type and magnitude of hazards involved in work on the equipment or system. They should understand what methods will be used to control those hazards, and they should know how to verify that the protection is adequate.

- The machine or equipment should be shut down using normal operating procedures. This produces an orderly shutdown and avoids the possibility of added hazards or equipment damage that might result from simply disconnecting the power or using some other unusual shutdown method.

- Equipment isolation devices must be physically located and operated in such a way as to isolate the equipment from the energy source.

  - Protection should not be based upon the presumed remote actuation of a circuit breaker or valve. As an additional protection, it may be possible to rack out a circuit breaker or remove a component (such as a fuse or a piping spool piece) to isolate the equipment from an energy source.

  - If a component is already tagged (from another lockout/tagout) it must NOT be operated or removed. Its position should be verified by all other appropriate means, e.g., observation of system parameters, valve position indicators, etc.

  - Personnel should verify the expected physical results of positioning each component. If undesirable conditions are encountered, e.g., inability to depressurize a piping system because of leakage through an isolation valve, the responsible supervisor or manager should be contacted for resolution.

- Tags and locks should be attached to all isolation devices to clearly indicate that operation is prohibited. In some large centrally controlled facilities, including most commercial power plants, tags alone have been found to be sufficient for protection. This is because of the training that all persons receive and the strict procedures that govern operation of equipment in these facilities.

  - If tags are used as the sole protection, the facility must demonstrate that the tagout procedures afford the same protection as lockout.

- In facilities using individual-controlled lockout/tagout, and in facilities where the training and familiarity with procedures of all personnel in the area cannot be determined, locks should be used along with tags to physically prevent unauthorized operation of isolation devices.

- When locks are used, each individual performing work (each lockout/-tagout holder in centrally controlled facility) should lock and tag each applicable isolation device, group lockout device, group lockbox, or comparable mechanism.

- In centrally controlled lockouts/tagouts, where many individuals or work groups may require protection from the same lockout/tagout, the number of individual locks on isolation devices could become excessive. The number of individual locks can be reduced and safety can be preserved by a "group lockout" system such as the one described in Section 4.5.3.

- Potentially hazardous stored or residual energy must be relieved, disconnected, restrained, or otherwise rendered safe. If it is possible for stored energy to reaccumulate, a means should be provided so workers can continue to verify that a safe level exists until completion of the work. This verification may be provided by opening a valve for draining or venting, breaking a flanged connection, installing grounding devices, or by other similar means. All such methods of verification should also be tagged to ensure that they remain effective during the work and that they are restored to operating condition when the lockout/tagout is removed.

- The isolating and deenergizing of the equipment and the proper installation of locks and tags should be verified by a qualified person. In addition, the adequacy of the protection should be verified by the individual(s) or work group representative(s) who will be working under the lockout/tagout. Verification should include checking that electrical systems show no voltage present (and are grounded if applicable), fluid and pneumatic systems are depressurized and vented (or drained if applicable), and all isolation devices are properly positioned, inoperable, and appropriately tagged.

- If facility procedures require independent verification of the system, it should be performed in accordance with *DOE Guide to Good Practices for Independent Verification*. If the sample Lockout/Tagout Record Sheet

(Appendix A) is used, the requirement for independent verification should be identified on Line [4].

4.5.2 Release and Removal of Lockout/Tagout

Like installation, release and removal of lockouts/tagouts have the potential to significantly affect personnel and facility safety. Release refers mainly to centrally controlled lockouts/tagouts. It ends the protection and permits the operations organization to change or remove the boundary isolations. If a form such as the sample Lockout/Tagout Record Sheet (Appendix A) is used, release occurs when an individual or work group representative signs in Block [10] of the form, removes any applicable individual/work-group locks (e.g., from a group lockbox), and turns over keys for other affected locking devices (e.g., integral-lock control switches).

Removal of a lockout/ tagout restores the energy availability to the equipment and returns the equipment to an operable condition, unless other current lockouts/tagouts affect the same equipment. Placing components in an operable condition when the lockout/tagout is removed does not mean placing them in operation. For example, removing a lockout/tagout would restore a circuit breaker to an operable condition, but would not close it; removal would restore the operability of a motor-operated valve, but would not open the valve. Approved operating procedures should be used for all operations, including equipment and system startup and post-maintenance testing.

In centrally controlled facilities, the following additional steps should be performed to ensure a safe release and removal of a lockout/tagout.

- Prior to releasing a lockout/tagout, the individual or work group representative should check that the machine or equipment is operationally intact. It would not be safe to remove the lockout/tagout if further work must be performed to make the equipment operational.

- The individual or representative should check to see that all nonessential items (e.g., tools, trash, etc.) have been removed from the work area. Returning to the area to retrieve tools or materials after the lockout/tagout has been released may be unsafe, and the area may be unsafe for operations personnel if housekeeping is not completed.

Only after all affected individuals and work group representatives have released a lockout/tagout can the operations organization remove the tags (and locks, if used) and place the equipment in an operable condition. The sequence for removal of tags and the final position of tagged components should be specified in the lockout/tagout procedure. As part of the restoration, the area should be checked to ensure that:

- The equipment is operationally intact, including all required guards and interlocks.

- Components within the lockout/tagout boundary are repositioned, if required, to permit safe operations

- Components that could cause automatic operation of a circuit breaker or a motor- or air-operated valve when control power or pressure is restored are in a position such that automatic operation will NOT occur during removal of the lockout/tagout.

Prior to removal of a lockout/tagout, the person responsible for operation should inform all affected personnel that the lockout/tagout is being removed and that the equipment will be operational.

The responsible individual, supervisor or manager should account for all tags prior to declaring the equipment operable and closing out the lockout/tagout. One effective method is to have all tags returned to be individually verified and destroyed or marked to prevent reuse. In some cases, such as tagouts that are applied in contamination areas, it may not be practical to personally verify and destroy the removed tags. Under such circumstances, alternative methods of verification should be developed.

In facilities using individual-controlled lockout/tagout, the person who installed a lock and tag should be the one to remove it. Each facility must develop specific procedures to be followed for lockout/tagout removal when the individual is unavailable, (e.g., has departed at the end of the shift). The appropriate supervisor/manager should assume responsibility for verifying that the individual is not available, authorizing the removal, and ensuring that the individual and all other affected personnel are informed prior to resuming work at the facility.

4.5.3 Group Lockout/Tagout

When maintenance is performed by a crew, craft, department, or other group, it is often advantageous to use a "group" lockout/tagout procedure. Such a procedure must afford personnel a level of protection equivalent to that provided by installation of personal lockout/tagout devices. The centrally controlled lockout/tagout described in this Guide meets that requirement when the following actions are performed:

- An authorized person (a member of the operations organization in centrally controlled facilities) locks and tags each isolation device.

- The keys from all isolation device locks are placed inside a lockable box. This box is then also locked and tagged.

- Each individual or work group representative requiring protection adds an individual lock and tag to the lock box.

No keys to isolation devices can be obtained until all individuals and work groups have released the lockout/tagout and removed their locks and tags from the lock box.

- After all individuals and work group representatives have removed their locks and tags from the lock box, the authorized person (or a person authorized by the responsible supervisor or manager in centrally controlled facilities) may remove the final lock and tag from the lock box. This makes the keys available for removing the remainder of the lockout/tagout.

4.6 Temporary or Partial Removal

As a general rule, temporary or partial removal of a lockout/tagout is discouraged, except when required as part of an approved work package, e.g., to stroke a motor-operated valve, to check phase rotation on a motor, or to test equipment functionality. It is important that a temporary or partial removal of a lockout/tagout is not regarded as an opportunity to take shortcuts. The same series of checks and precautions is required whether one tag is being removed or the entire lockout/tagout. All lockout/tagout holders must release the lockout/-tagout before any tags are removed or any changes are made in the isolation boundaries.

After the activity that required temporary or partial removal of the lockout/tagout is completed, the lockout/tagout will either be reapplied or completely removed. If the lockout/tagout is to be reapplied, the equipment must be shut down, deenergized, verified, and locked/tagged just as it was for the initial application. If a record like the sample Lockout/Tagout Record Sheet (Appendix A) is being used, the new tags should be added to the list in Block [12] of that sheet. If the lockout/tagout is to be completely removed, it must be done in accordance with the normal procedure for release, removal, and restoration.

4.7 Shift or Personnel Changes

Ensuring personnel safety and continued work boundary isolation during shift or personnel changes requires special attention. All facilities should establish procedures for the orderly transfer of responsibility and protection under a lockout/tagout.

4.7.1 Facilities Using Individual-Controlled Lockout/Tagout

Facilities using individual-controlled lockout/tagout may be able to use the following method: The off-going and oncoming persons together review and verify the lockout/tagout. At each energy-isolating device, oncoming persons attach their own new tag and off-going persons remove their tag. All keys for applicable locking devices are turned over to the oncoming person. This transfers "ownership" of the lockout/tagout without releasing control over the energy-isolating devices.

4.7.2 Facilities Using Centrally Controlled Lockout/Tagout

Facilities using centrally controlled lockout/tagout should ensure that control of the lockout/tagout is maintained during shift changes. If a new work crew is taking over the work, or if outside vendor personnel are involved in the work, each individual or work group representative should release their lockout/-tagout(s) at the end of the shift for turnover to the oncoming personnel. At the beginning of each shift, each individual or work group representative should verify the adequacy of lockout/tagout protection and receive new authorization from the responsible supervisor or manager before beginning work.

If a form like the sample Lockout/Tagout Record Sheet (Appendix A) is used, the release at the end of a shift should be recorded in Block [10] of the sheet. At the beginning of the next shift, each individual or work group representative should be entered on a new line in Blocks [7] and [8]. Authorization for work to begin should be recorded in Block [9] for each period of work. Sheets should be added as required to record additional entries.

4.8 Periodic Inspection

Facility procedures should outline periodic review and inspection responsibilities for lockout/tagout. Documentation for each review/inspection should include the date and time of the inspection, the name/signature of the person conducting the inspection, any deficiencies noted, and corrective action(s) taken.

Facility operators should inspect for correct placement of tagout devices (and locks, if used) and correct position of tagged equipment as part of their normal rounds. Operators should notify the responsible supervisor or manager if deficiencies are noted.

Each shift, lockout/tagout holders should inspect the work boundary isolation devices to verify that tagout devices (and locks, if used) are properly installed. At facilities where ALARA concerns would limit such inspections, operations management should establish an inspection frequency that is consistent with dosage control considerations. Lockout/tagout holders should inform affected personnel and the responsible supervisor or manager if deficiencies are noted.

Supervisors should inspect work boundary isolation devices to verify that tagout devices are properly completed and installed to warn against operation, locks (if used) are properly installed to prevent inadvertent operation, and devices are properly positioned to provide the required protection. They should interview personnel installing, removing, and working under lockouts/tagouts to determine their knowledge of responsibilities. They should review the documentation for current and removed lockouts/tagouts to ensure that the documentation meets all requirements and accurately reflects the current status. Supervisors should document each inspection, including the date, person(s) performing the inspection, equipment and procedures involved, and personnel participating in the inspection. They should initiate corrective action for any deficiencies.

Managers should inspect facilities or areas under their control at least annually for overall

compliance with facility lockout/tagout requirements. Facilities having a high level of lockout/tagout activity or a history of problems involving lockout/tagout should be inspected more frequently. Managers should document their inspections, including any deficiencies found and corrective actions initiated.

4.9 Outside Contractors

Whenever outside contractors or other outside servicing personnel are engaged in work covered by the lockout/tagout program, there may be differences in interpretation and application. The facility supervisor and the contractor should discuss the protection requirements for the job. All lockout/tagout protective measures should be applied in accordance with facility procedures. The contractor should ensure that the procedures are understood by all subordinate contractor personnel.

4.10 Training and Communication

A lockout/tagout program cannot provide consistent worker and equipment safety if all personnel do not understand and comply with its requirements. All employees may potentially be affected by the lockout/tagout program, whether through their own work activities or the work of others. Therefore, facilities should ensure that each employee receives an appropriate level of training on the purpose and function of lockout/tagout. OSHA requires all affected personnel to be trained on the contents of the lockout/tagout program and the requirements to implement it effectively. The training should include:

- Lockout/tagout program
  - Recognition of lockout/tagout
  - Purpose of lockout/tagout procedures
  - Use of lockout/tagout procedures
- Lockout/tagout compliance
  - Locks and tags not to be bypassed, ignored, or otherwise defeated

- Locks and tags not to be removed without proper authority

- Tag limitations
  - Tags are warning devices only and do not provide physical restraint against operation
  - Effectiveness depends on compliance by all personnel

Personnel authorized to isolate equipment and install locks and tags, and persons designated as lockout/tagout holders in centrally-controlled facilities, should receive additional training in the areas listed below.

- Hazardous material and energy sources
  - Recognition of sources applicable to the facility
  - Magnitude and type of energy or materials involved
  - Methods and means to isolate and control
- Lock limitations
  - Necessary facility operation may be hindered by locks
  - Locks and chains could contribute to seismic loading of small instrument line valves

Facilities should evaluate the need for additional training following changes in job assignments, machines, or processes.

4.11 Caution Tags

Caution tags SHALL NOT be used for protection of personnel performing maintenance or for energy isolation, but they may, at the facility's option, be administered by a common tagging procedure.

Use of caution tags should be restricted to situations in which a component or system is functional, but some precaution or other item of information is needed prior to its operation. For example:

> A piece of equipment has both an automatic and a manual mode of operation. A problem develops in the automatic control, making that mode of operation unreliable, but the equipment is still functional. A caution tag would be appropriate to warn an operator of the limited operational capability and the need to monitor the equipment in the manual operating mode.

Caution tags should NOT be used in the place of more appropriate action, such as a temporary or permanent procedure change, placing an operator aid, use of the work control system, or corrective maintenance. The instructions contained in a caution tag should not conflict with established facility procedures or technical safety requirements.
If caution tags are used in a facility, the program should include the following elements:

- The use of caution tags should be controlled and documented.

  - Situations requiring special operator or maintenance precautions should be brought to the attention of the responsible supervisor or manager.

  - The appropriate supervisor or manager should determine the need for each caution tag and authorize its placement.

  - Caution tags should be placed so that they are readily apparent to an individual prior to operation of the tagged device, but they should not obscure indications or interfere with switches or other control devices.

  - A facility log should document all caution tags issued in the facility, including their status and additional amplifying information.

  - All caution tags should be reviewed periodically to verify their continued need and applicability.

  - Caution tags remaining active for long periods (e.g., longer than three months, or other facility guideline) should be brought to the attention of the responsible supervisor or manager for action to resolve the problem.

- Caution tags should be easily identifiable and unique in appearance compared to other tags used at the facility. Caution tags should contain the following information:

  - Caution tag number

  - Component identification number and name

  - Effective date

  - Precautions and amplifying instructions

  - Signature and organization of the person authorizing the caution tag.

APPENDIX A
(SAMPLE) LOCKOUT/TAGOUT RECORD SHEET

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(SAMPLE) LOCKOUT/TAGOUT RECORD SHEET

[1] Lockout/Tagout Number - - -
Facility - Year-Number

[2] Component/System:

[3] Requested By:

[4] Independent Verification Required at Lockout/Tagout Yes No

[5] Safety-Related Testing Required Yes No
Specify testing conducted:

[6] Lock/Tag Preparation (Block [12]) completed; Placement of Locks/Tags Authorized

(Operations Supervisor)

[7] Issued For	**[8]** Accepted (Lockout/Tagout Holder)		**[9]** Work Authorized (Responsible Supervisor)		**[10]** Release Lockout/Tagout (Lockout/Tagout Holder)	
Activity Identification	Name	Date/ Time	Name	Date/ Time	Name	Date/ Time

Blocks [7], [8], [9], & [10] continued on additional sheets? ❑ Yes

[11] Restoration (Block [14]) Completed / Operability Checks Satisfactory

Specify testing performed:

(Responsible Supervisor or Manager)

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Completion of the (Sample) Lockout/Tagout Record Sheet

Lines [1], [2], and [3] request administrative information to identify the lockout/tagout, the equipment affected, and the name of the requester.

Line [4] requires determination of any independent verification requirement at the time the lockout/tagout is applied. Independent verification may be required on some systems, particularly safety systems, following installation of a lockout/tagout to ensure that required safety functions have not been inadvertently affected. Additional information concerning independent verification requirements can be found in *DOE Guide to Good Practices for Independent Verification*.

Line [5] requires identification of safety-related testing requirements, in accordance with facility safety standards.

Line [6] confirms the proper listing of tagout points (Block [12]) and preparation of tags, and documents approval by the responsible supervisor or manager to begin installing the lockout/tagout.

Block [7] provides space to identify the work activity(ies) requiring protection under this lockout/tagout. Activities may be identified by their work control document number, procedure number, etc.

Block [8] provides space for appropriate lockout/tagout holders (individuals or representatives of work groups) to document their acceptance of the lockout/tagout as adequate protection for their intended work.

Block [9] provides space for the responsible supervisor or manager to document that the lockout/tagout has been properly installed and that work is authorized to begin for each individual, work group, or shift.

Block [10] provides space for these individuals or work group representatives to document their release of the lockout/tagout at the end of the job (or shift).

Block [11] provides for the responsible supervisor or manager to document the closure of the lockout/tagout after it has been released by all users (Block [10]) and has been removed and restored to operational condition (Block [14]). If post-maintenance testing is required to prove operability, it should be identified in Block [11].

Blocks [12], [13], and [14] document the preparation, placement, and removal of each individual tag. Block [12] provides space to list components that will form isolation boundaries around or verification points within the work area, the required position of each component, and the sequence in which the tags should be placed. The authorized persons who prepare the list and tags and who verify the accuracy and adequacy of the protection should be identified in the spaces labeled "Prepared by" and "Verified by." Block [13] documents the positioning of components and the placement and verification

of each tag. Block [14] documents the required position of each component to restore it to an operable condition, sequence for restoration, authorization for removal of each tag, tag removal and restoration of each component to operable condition, and verification.

Block [15], the remarks section, provides space for amplification on any action required or condition observed during placement, verification, or removal of tags (and locks, if used). For example, if two-valve isolation cannot be achieved in a hazardous system, or if verification cannot be performed because of high radiation, a statement in the remarks section should document the affected component(s), the reason, and the appropriate supervisory approval. Block [15] should also be used to identify (by signature, initials, and position) the personnel performing specific lockout/tagout actions, such as installing tags, verifying installation, removing tags, verifying removal, or adding tags to an existing lockout/tagout record.

DOE-STD-1030-96

CONCLUDING MATERIAL

Review activities:
DOE-DP
DOE-EH
DOE-EM
DOE-ER
DOE-NE
DOE-NS
DOE-PAPO

Preparing activity:
EH-31
Project Number:
SAFT-0056

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December 1992

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December 1998

DOE STANDARD

GUIDE TO GOOD PRACTICES FOR COMMUNICATIONS

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

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Guide to Good Practices for Communications

Page/Section	Change
pg. 9 / section 4.1.2.6	This section was added.
Concluding Material	The Preparing Activity was changed from NE-73 to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

KEYWORDS

Face to Face
Portable Radios
Sound Powered Phones

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APPENDIX A
PHONETIC ALPHABET A-1

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DEFINITIONS

Communications	The process of sending and receiving information.
Emergency Communications	Urgent messages transmitted during an emergency situation concerning the operation of the facility.
Face-to-Face Communications	The act of directly communicating verbally without the aid of mechanical or electrical communications equipment.
Public Address (Paging) System	A communication system designed to be heard in all areas of a facility.
Operational Communications	Messages concerning the operation of the facility.
Portable Radios	Any radio communications system where at least one station is remote and portable.
Sound-Powered Phones	A party or dedicated line providing communications among two or more specific stations without the need for external power.
Verbal Communications	Messages that are transmitted by voice and received by ear (written notes or other physical aids may be used in conjunction with verbal communication to aid in remembering the specific details of the message).

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GUIDE TO GOOD PRACTICES FOR COMMUNICATIONS

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Communications, Chapter IV of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The practices in this guide should be considered when planning or reviewing communication programs. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Communications" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for high reliability in communications to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

Communications, both normal and emergency, are highly reliable and provide accurate transmission of information within the facility.

Criteria:

1. Communication methods are implemented to ensure timely and reliable contact with essential personnel such as supervisors or on-shift operators.

2. Only facility approved abbreviations and acronyms are used in facility communications.

3. Communications are clear, concise, and correctly understood.

4. Portable radio use is monitored and controlled to prevent electronic interference in sensitive instrument areas.

5. A facility paging system is effectively used and controlled to ensure the impact of important announcements is not reduced.

6. An Emergency Communications System is implemented to ensure all facility personnel are promptly alerted to facility emergencies.

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3. DISCUSSION

All of us depend on verbal communication for the exchange of information or instructions. Depending on the job, an individual may be responsible for transmitting or receiving information in the form of operating instructions, feedback on the results of operations, reports of operational data, or emergency warnings and instructions. Whether face-to-face or electronic communication, this information has to be transmitted and received; it has to be accurate and complete; most importantly, it has to be understood.

Communication problems have caused many adverse situations in Department of Energy (DOE) facilities. Inadequate communication can be identified as a causal or contributing factor in human performance-related events. Principal areas in which poor communications can cause problems include shift turnover, pre-job briefings, and during job performance. Facilities can reduce the contribution to adverse situations by ensuring that verbal communications are conducted in a formal and disciplined manner and that communication systems are properly used. Formality in communication is especially important when personnel safety is involved or complex evolutions are performed.

Just as there are different messages to be communicated, there are different methods of audible communication (e.g., face-to-face, party-line, point-to-point, and public address announcements). Each method requires the use of specific techniques to effectively communicate the necessary information. This guide presents communication techniques that have proved successful in the commercial industry, government, and the military.

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4. GOOD PRACTICES

4.1 Oral Instructions and Informational Communications

4.1.1 Attributes

Verbal instructions should be clear, concise, and correct. Before sending instructions, a sender should plan what to say, then say it to him/herself to ensure that it has all of the message attributes. Then the sender should say it to the intended receiver.

4.1.1.1 Clear

Operational communications must be free from ambiguity. Messages that contain words with multiple meanings or similar sounds may be confusing (e.g., use "raise" and "lower" instead of "increase" and "decrease"). Slang and expletives should not be used. Equipment noun names and numbers should be used (e.g., "Open feedwater pump discharge valve one six."). When communicating alphanumeric information, both sender and receiver should use a phonetic alphabet to ensure clarity. Appendix A is a suggested phonetic alphabet. An exception to this practice is the use of approved standard abbreviations such as "ACW" for auxiliary cooling water.

Only facility-approved terminology, equipment identifications, and abbreviations should be used. A list should be developed of standardized and facility-specific terminology to be used during communications. This list should include the terms, applicable written abbreviations, and verbal acronyms.

4.1.1.2 Concise

Operational communications should be as brief as possible. The key is to keep the message as short as possible while still effectively communicating the information. Using approved verbal acronyms should keep messages short. This is especially important during emergencies (e.g., when a work station reports an emergency condition to the control area). However, when using the public address system to announce emergencies (e.g., evacuation, fire, take cover) the use of acronyms should be avoided so that all personnel, including new employees and visitors, clearly understand the actions they are to take.

4.1.1.3 Correct

The message should be specific to ensure that the correct unit or component (Alpha or Bravo; 1 or 2) is identified. Noun names and equipment numbers should be used together to ensure that the message is properly transmitted and received.

4.1.2 Format

Operational communication should use a standard format to ensure consistency and effectiveness. The suggested format, in the appropriate order is:

- Establish communication
- Transmit message
- Repeat back message
- Confirm repeat back

4.1.2.1 Establishing Communications

Before transmitting a message, communications must be established between the sender and the intended receiver. The sender should identify the intended receiver and then him/herself. Either formal names or work station titles may be used as identification, however, work station titles are preferred.

Example: "Control Room Operator, this is the Auxiliary Operator."

This lets the person receiving the message know who is directing an action or requesting information. When answering a phone, radio, etc., the receiver should identify the work station followed by his/her title or name.

Example: "Control Area, Control Room Operator."

This lets the sender know if he/she has contacted the intended location and person.

4.1.2.2 Transmitting the Message

Once communications have been established, the message text can be transmitted. The message attributes presented earlier should be used during transmission.

Example: "Building Operator, this is the Control Area Operator. Open Cooling Water Suction Valve, Foxtrot two five."

The receiver should make notations when receiving complex or lengthy communications to ensure that important information is not forgotten. For example, operators should write down valve numbers and final valve position when directed to reposition valves in a specific sequence. This ensures that actions are correct and in the required sequence. If the receiver does not understand the message, he/she should ask the sender to repeat or rephrase the message.

If the message is an abnormal or emergency condition report, personnel should exercise additional care to speak slowly, clearly, and accurately. These reports should include the nature, severity, and location of the problem. During abnormal or emergency reports, communication lines should be kept open for subsequent reports (i.e., stay on the line,

unless directed otherwise or where environmental conditions or personnel hazards require evacuation for personnel safety). If conditions require immediate evacuation, contact should be made with the Control Area after successful evacuation.

4.1.2.3 Repeatback

In operational communications, the receiver should repeat the message back to the sender. This is especially important when receiving instructions involving operation of facility equipment to assure the sender that the instruction is correctly understood. A verbatim repeatback is preferred, although paraphrasing may be used as long as the intent of the message is clearly stated. If notations of equipment, numbers, and positions were made during the original transmission, the repeatback should contain the same information.

Example: "Control Area, this is the Building Operator. Understand, open Cooling Water Suction Valve, Foxtrot two five."

The sender must listen carefully to repeated messages to ensure the receiver understands the message. If the receiver repeats the message incorrectly, the sender should immediately correct the receiver by saying "Wrong" and repeat the message until properly received.

4.1.2.4 Confirmation

After the repeatback, the sender should confirm or correct the receiver. The absence of the confirmation step may result in miscommunication because the receiver may have misheard the instructions and repeated erroneous information. A lack of response by the sender may be misinterpreted as silent confirmation that the repeated message was correct. However, the receiver should not carry out the action until confirmation is received.

Example: "Building Operator, this is the Control Area Operator. That is correct."

4.1.2.5 Reportbacks

Another part of operational communication is the reportback. When directed to perform a task, a report should be made concerning the completion of the task or difficulties encountered as soon as possible. The appropriate supervisor or control area operator should acknowledge this communication so that the sender is confident the report was received.

4.1.2.6 Briefings for Operators

Briefings can provide information to operators during normal and emergency operating conditions. Information should be concisely transferred among the operators by well organized briefings. Managers can ask questions or

review assignments to verify that the operators understand the information presented, after completion of the briefings.

During facility operation, the briefings should be held before facility activities such as surveillances, maintenance troubleshooting, or component manipulations. Briefings should be conducted frequently, for abnormal or emergency operating conditions, to confirm that operators understand facility conditions and emergency operating procedures.

4.2 Face-to-Face Communication

Face-to-face communication is performed when the sender and the receiver are in the presence of each other. The sender's title may be omitted from the message, however, the sender should ensure that the intended receiver receives the message when two or more people are in the immediate area. The use of sign language in lieu of audible communications should only be performed in accordance with prescribed guidelines (e.g., hand motions for crane operators).

Example: Face-to-face operator communications to increase Service Air Header pressure:

Control Room Operator (CRO) to Facility Equipment Operator (FEO):

> "Facility Equipment Operator, raise Service Air Header pressure to one five zero pounds."

Response by FEO Operator:

> "Raise Service Air Header pressure to one five zero pounds."

Acknowledgment by CRO:

> "That's correct."

4.3 Communication Systems

Communications systems should be implemented to ensure that control areas can quickly contact personnel throughout the facility. In addition, these systems should allow contact between personnel outside of the control area.

4.3.1 Party-line Communication Systems

A party-line communication system allows more than two work stations to communicate on the same communication line at the same time. If a party line communication system is used, the sender should check the line to verify that the line is clear prior to establishing communications. This should prevent "cutting in" on other conversations. In addition, the sender and receiver identification should be included in each message. To gain access to a party line in the event of an emergency, the phrase "Silence on the line, this is an emergency" should be used to clear the line for priority communications.

Example party-line radio communications concerning filling and venting of Service Water piping:

Auxiliary Operator (AO) to Outside Facility Equipment Operator (FEO):

> "Outside FEO, this is the AO. Vent service water header one Bravo using valve Sierra Whiskey one seven."

Response by Outside FEO:

> "AO, this is the Outside FEO. Vent service water header one Bravo using valve Sierra Whiskey one seven."

Acknowledgment by the AO:

> "Outside FEO, this is the AO. That is correct."

4.3.2 Point-to-Point Communication Systems

A point-to-point communication system allows only two work stations to communicate on a communication line at one time. If a point-to-point circuit is used, the sender and receiver identification need only be established on the initial contact.

Example point-to-point telephone communications concerning a Waste Evaporator Distillate Tank:

Radwaste Facility Equipment Operator (FEO) to Control Room Operator (CRO):

> "CRO, this is the Radwaste FEO. The Waste Evaporator Distillate Tank is full. Request to pump the Waste Evaporator Distillate Tank to Waste Holdup Tank Alpha."

CRO to Radwaste FEO:

> "Radwaste FEO, pump the Waste Evaporator Distillate Tank to Waste Holdup Tank Alpha."

Response by Radwaste FEO:

> "Pump the Waste Evaporator Distillate Tank to Waste Holdup Tank Alpha."

Acknowledgment by CRO:

> "That's correct."

4.3.3 Public Address (Paging) Systems

Public address (paging) systems may be used to update facility personnel of the status of an abnormal or emergency condition, changes in facility status, or major facility events either in progress or anticipated. Administrative policies and procedures should address the effective control of the public address system. Public address systems, if used, should be designed to be heard throughout a facility. When using the public address system, senders should speak slowly, deliberately, and in a normal tone of voice. Since the paging system is heard throughout the facility, the sender normally need not specify a receiver. An exception to this rule would be during casualties when the control area would direct actions using the public address system.

Announcements of abnormal or emergency conditions should be made twice. If an audible alarm signal is used in conjunction with the public address system to warn personnel of an abnormal or emergency condition, the alarm should be activated once, before the announcement. The alarm signal will alert personnel to listen for the message that follows. Where noise levels are excessive, other means of communicating emergencies should be considered, such as flashing lights. Repeatbacks and the identification of sender and receiver may be omitted.

When using the public address system to announce remote starting of major equipment, the announcement should be made, followed by a short pause, and then the equipment started. The pause is required to allow personnel to move away from the equipment.

If other communication systems are used to access the public address system (e.g., facility dial phone number that actuates the public address system), the control area should have the capability to override those systems. The use of the override should be authorized only for emergency announcements and authorized tests. Policies and procedures should clearly define when and who may use the public address system from these other sources.

4.4 Communication Equipment

4.4.1 Portable Radios

Portable radios are considered any communication system where at least one station is remote and portable. They are an effective means of communicating with personnel who tour large work stations, especially when the tour takes them away from stationary communication equipment. Portable radios used in normal facility operations may also be used in an emergency to communicate with mobile units.

Prior to assigning a portable radio to a work station, it should be tested from all areas within the work station. This test will ensure that communications can be established, especially during emergency situations. Because of structural interference (e.g., concrete walls, large equipment, I-beams), power output of the radio may be insufficient to communicate. In this situation, consideration may be given to raising the output power of the radio. If a portable radio cannot be used from specific areas within a work station, alternate communication equipment must be supplied.

Since portable radios are a large contributor to control area noise levels and radio frequency interference, their use must be controlled. A list of all electronic cabinets that are susceptible to radio frequency interference should be established and posted with signs prohibiting use. It is advisable not to key portable radios within approximately 10 feet of posted electronic cabinets.

Facilities may dedicate specific channel frequencies for different organizations. For example:

- Channel 3 (three) for Operations Department personnel and for other personnel when reporting abnormal operational conditions to the control area (In this case the control area should continuously monitor channel three.)

- Channel 4 (four) for dedicated support groups, such as maintenance and facility services

- Channel 5 (five) for Security Force personnel.

4.4.2 Sound Powered Phones

Sound powered phones allow communications between two or more specific stations without the need for external power. Sound powered phones may be used with party-line or point-to-point communication systems. Since sound-powered phones require no external power, they can be used during power outages. When available, this is the preferred communication equipment for routine testing, post-maintenance testing, or special operational situations that require coordination through communication.

4.4.3 Personal Pagers

Personal pagers may be provided to operating personnel working in areas where the facility paging system cannot be heard. Personnel pagers that vibrate and can be felt may also be used in work areas with high noise levels.

4.4.4 Dial Telephones

Dial telephones, those used for normal telephone communication, are an acceptable form of facility communications. Since telephone lines already exist in most facilities, spending additional money to install extra systems may not be needed. One drawback to standard telephone systems is that they are normally point-to-point systems and, if an emergency announcement is needed to be made, the sender may get a busy signal. Alternate emergency communication devices should be used to preclude this situation.

4.5 Emergency Communication Systems

The facility emergency communication system should ensure that all personnel can be promptly alerted to facility emergencies. The public address system should normally be used to make emergency announcements. Alternate methods, such as flashing lights, personal pagers, and individuals dedicated to notifying in person should be used to alert personnel in high-noise areas. The emergency communications system should also allow personnel from any point in the facility to make emergency communications to the control area. Designated facility telephone numbers should be established to report concerns or problems. Numbers should be easy to remember, such as:

- 111 (Security problem)
- 222 (Radiological concern)
- 333 (Fire, personnel injury, abnormal or emergency operational condition. Channel 3 on the public address system, while normally used for operations, may also be used for emergency communications.)

Direct telephone communication lines should be provided between the control area and the emergency response facilities to improve emergency response to accidents. These communication links should only be used during a declared emergency event, during authorized testing, or when authorized by the shift supervisor. Specific guidance for the use of these communication links should be in the site emergency plan and implementing procedures.

4.6 Testing Communication Systems

Policies and procedures should address testing of communication systems. At a minimum, emergency communication systems should be tested periodically to ensure that they are operable. Although, it is advisable to periodically test all communication systems. Testing periodicity for certain emergency communication

systems is generally governed by federal requirements (e.g., communication systems used for life safety). The test periodicity for non-emergency communication systems should correlate to the risk associated with not being able to use the communication system. In addition, a test of a communication system should be performed prior to conducting procedures that require use of the system, and anytime system operability is in doubt. A physical inspection of all communication equipment, system connections, transmitters, and antennas should also be performed.

A check of all facility areas should be periodically performed to make certain that facility personnel can be alerted to emergency conditions. As part of the operability check of the emergency communication system, personnel throughout the facility should make reports to the control area, acknowledging an acceptable test.

The following external emergency communication systems/paths should be periodically tested:

- Communications between the facility and DOE
- Communications between the facility and state and local government agencies
- Communications between the control area and offsite facility support centers, if they exist.

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APPENDIX A
PHONETIC ALPHABET

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PHONETIC ALPHABET

To minimize misinterpretation, use the phonetic alphabet when alphanumeric information is being communicated:

A - Alpha	N - November
B - Bravo	O - Oscar
C - Charlie	P - Papa
D - Delta	Q - Quebec
E - Echo	R - Romeo
F - Foxtrot	S - Sierra
G - Golf	T - Tango
H - Hotel	U - Uniform
I - India	V - Victor
J - Juliett	W - Whiskey
K - Kilo	X - X-ray
L - Lima	Y - Yankee
M - Mike	Z - Zulu

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CONCLUDING MATERIAL

Review Activities:

DOE
DP
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EM
ER
NE
NS

Preparing Activity:

DOE-EH-31

Project Number:

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GUIDE TO GOOD PRACTICES FOR OPERATIONS ORGANIZATION AND ADMINISTRATION

U.S. Department of Energy
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December 1998

Guide to Good Practices for Operations Organization and Administration

Page/Section	Change
p. viii / Definitions	The following sentence was added. "Technical Safety Requirements consist of safety limits, operating limits, surveillance requirements, administrative controls, use and application of instructions, and the basis thereof."
p. 1 / Introduction	The following sentence was added. "This standard should be used in conjunction with principles of the Integrated Safety Management System as incorporated in DOE G 450.4-1, *Integrated Safety Management System Guide*."
p. 21 / Supplemental Resources	The following resource was added. DOE G 450.4-1, *Integrated Safety Management System Guide.*
Concluding Material	Preparing Activity was changed to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

KEYWORDS

Facility

Operations Supervisor

Technical Safety Requirements

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DEFINITIONS

Facility	Any equipment, structure, system, process, or activity that fulfills a specific purpose.
Root Cause	The cause that, if corrected, would prevent recurrence of this and similar occurrences.
Operations Supervisor	The individual having authority and responsibility for operational control of a facility, process, experiment, or other project.
Safety Analysis	A documented process which provides systematic identification of hazards within a given DOE operation (or for a given job in the case of job safety analysis); describes and analyzes the adequacy of measures taken to eliminate, control, or mitigate identified hazards; and analyzes and evaluates potential accidents and their associated risks.
Safety Analysis Report	A report which documents the adequacy of the safety analysis for a facility to ensure that the facility can be constructed, operated, maintained, shutdown, and decommissioned safely and in compliance with applicable laws and regulations.
Technical Safety Requirements	Those requirements that define the conditions, safe boundaries, and the management or administrative controls necessary to ensure the safe operation of a nuclear facility and to reduce the potential risk to the public and facility workers from uncontrolled releases of radioactive materials or from radiation exposure due to inadvertent criticality. Technical Safety Requirements consist of safety limits, operating limits, surveillance requirements, administrative controls, use and application of instructions, and the basis thereof.

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GUIDE TO GOOD PRACTICES FOR OPERATIONS ORGANIZATION AND ADMINISTRATION

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Operations Organization and Administration, Chapter I of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The practices in this guide should be considered when planning or reviewing operations organization and administration programs. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19. This standard should be used in conjunction with principles of the Integrated Safety Management System as incorporated in DOE G 450.4-1, *Integrated Safety Management System Guide*.

"Operations Organization and Administration" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for well-defined standards and requirements for safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

The organization and administration of facility operations ensures that a high level of performance in operations is achieved through effective implementation and control of operations activities.

Criteria:

a. Written operating standards are established.

b. Sufficient human and material resources are provided to accomplish assigned tasks.

c. A program to monitor operating performance is implemented to improve facility operations by identifying and resolving operational problems.

d. Safety, environmental, and operating goals are established for measuring operating effectiveness and improving operating performance.

e. Personnel are held accountable for operating performance.

f. Supervisory and management training is provided.

g. Safety planning guidance is established for all operational activities.

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3. DISCUSSION

Operational excellence is the main goal of DOE and DOE facilities; protecting the environment and improving safety and productivity complement this goal. A facility's organization must be properly directed to ensure that all three elements are effectively addressed. Establishing policies and setting goals to achieve a safe, environmentally conscious, and efficient operating facility are essential to focus this direction. These policies and goals are an effective method of communicating direction to all personnel.

The organization and administration of facility operations should clearly define the process for providing and supporting safe, reliable, and efficient conduct of all facility activities. Emphasis must be placed on teamwork to ensure this occurs. A clear understanding by personnel of their authorities, responsibilities, accountabilities, and interfaces is essential to proper functioning of the organizational team. The organizational structure must be clearly defined, and the administrative controls implementing the structure must be formally documented to achieve this understanding.

Management must emphasize performance standards and individual accountability in adhering to policies and accomplishing goals. When personnel are aware of the performance standards required to meet the goals, they will be more inclined to acknowledge their accountability. In addition, personnel must be allowed the opportunity to supply input to the policies, goals, and standards so that they have a sense of ownership of the facility. Given this opportunity, personnel will more willingly support standards and accept accountability.

Personnel must have the resources needed to perform their jobs. Restricting or delaying resources will only hinder operational effectiveness and may result in adverse consequences. Because personnel are one of the resources required to operate a facility, a plan to retain sufficient personnel to safely and efficiently operate the facility must be developed.

To ensure that resources are being properly used and operating activities are directed towards goals, management must monitor operations. Monitoring facility operating

performance is the best way to measure the facility's effectiveness in accomplishing goals. Monitoring activities such as audits, reviews, tours, and self-assessments are part of the checks and balances needed in an effective operating program to ensure that management obtains a clear picture of facility operations. Touring also allows management to interface with facility personnel and reinforce policies and goals. Audits, reviews, investigations, and self-assessments supply information for facility performance reports. These reports provide evidence of the operating performance of the facility. Facility performance reports enable tracking and trending of performance indicators and can be used to adjust goals. When operating problems or undesirable performance trends are noted during monitoring, corrective actions must be developed and implemented to redirect performance. Followup monitoring activities allow management to verify the effectiveness of the corrective actions.

In order to effectively monitor operations and manage resources, managers must be trained. A management development program will enhance the skills and knowledge of upcoming managers and supervisors. This is especially true of first-line supervisors because they usually have no previous management experience, but must possess the proper attributes to handle their responsibilities.

Management must strive to develop and maintain a proper safety attitude in all facility personnel. A comprehensive safety program must include planning for safety. If safety planning accompanies work planning, safety issues will be confronted before actual work is started. Planning will minimize work holdups and operating schedule delays that result from correcting safety issues. Personnel must also be trained in safe operating practices and the need to identify potential personnel hazards at their work stations. Management monitoring of performance, stressing safety and planning for safety, will reinforce this attitude.

4. GOOD PRACTICES

4.1 Policies

Written policies should ensure consistency in the organization and administration of facility activities. Facility-wide policies should be developed for activities that affect the entire facility or when they apply to multiple organizations (departments) within the facility. Policies for activities specific to an organization should be developed at the organization level.

Policies should be written in a consistent format for effective development and implementation. The required format (e.g., procedures, checklists, and other definitive documentation) should be clearly defined. Policy documentation should contain a description of the controls necessary to implement the policy and should specify when and how changes may be made to the policy. Policies should be easily understood and should adequately address the subject matter. Therefore, standard names for facility work groups, positions, locations, systems, and equipment should be established. Lower-tier policies should be consistent with those at the facility level to ensure continuity. Policies that are no longer needed, or have been superseded, should be canceled and removed from use.

Personnel should clearly understand their authorities, responsibilities, and accountabilities associated with policies. In addition, personnel should understand their interfaces with other organizations, especially during back-shifts and weekends (e.g., engineering, maintenance, security). Therefore, these items should be clearly defined. Once policies have been established, personnel should be instructed on their purpose, the benefits of following them, and the consequences of not following them.

4.2 Goals

As a standard policy, facility management should develop goals that support established DOE and corporate goals. Operating, environmental, and safety goals should be used as motivators for improvement. The purpose is not simply to meet a numerical goal; rather, the purpose is to improve operating performance. Goals should be used as a management tool for involving cognizant groups or individuals in improving operating performance and for measuring operating effectiveness. Goals that focus on areas that need improvement and that promote excellence in facility operations can be used by management to establish facility priorities and monitor progress. Goals should be realistic yet challenging. Easily achievable goals should be avoided. All goals should be coordinated among the various levels of management to ensure that they are consistent and mutually supportive and that they reflect the overall mission of the facility.

In addition, goals should be:

- Measurable, allowing specific measurement of progress and clear determination of achievement
- Limited in number so that employees can effectively focus their efforts
- Controlled by the individual or group responsible for their accomplishment
- Clearly communicated, understood, and supported by all members of the responsible organization
- Composed of input from all levels in the organization responsible for achieving the goals.

When the performance of support groups (those not reporting to the operations supervisor) directly affects facility activities, the operations supervisor should review the

goals of the support groups to ensure that they are consistent with, and complementary to, those developed by operations line management.

Where appropriate, action plans (policies) should be developed for achieving goals. The action plans should specify the actions and responsibilities of each individual contributing to achieving the goal. Milestones should be established to track progress.

Management should periodically review progress toward accomplishing goals. Formal reviews should be conducted and results communicated to facility personnel. If results show a significant variance from the desired progress in achieving goals, management should review the action plan to ensure that it is adequate and being effectively executed and that allocated resources are sufficient. Based on the results of the review, changes to goals should be considered if conditions have changed since the time the goals were established and the impact of the revised goals has been assessed on the overall performance of the facility.

Operational goals should be established in areas such as:

- Preventing unavailability of safety systems
- Preventing personnel error
- Maintaining exposure as low as reasonably achievable (ALARA)
- Preventing lost facility capability (e.g., lowered output, less effective)
- Preventing unscheduled facility shutdowns
- Maximizing the timely completion of scheduled surveillances
- Minimizing the amount of overtime
- Maintaining complete staffing and training of shift positions

- Minimizing or preventing waste, as appropriate

- Minimizing the number of lighted annunciators and out-of-specification parameters.

Management should foster a working environment that encourages individual performance and teamwork to achieve its goals. Management should also encourage an atmosphere conducive to constructive criticism and feedback. They should respond to feedback and communicate the actions taken as a result of the feedback to encourage continued participation.

4.3 Accountability

All DOE facility personnel shall be held accountable for their operating performance. Management should ensure that all personnel understand the requirements for their assigned work stations and that individuals will be held accountable for their actions or inactions. Personnel should be instructed on the benefits of proper operating performance and the possible consequences of inappropriate operating performance.

A well-defined accountability program should define the requirements for handling operating performance problems. Personnel involved in any infraction of operating practices should be counseled on the deviation. Those involved in significant or frequent violations of operating practices should be counseled, retrained, and disciplined, as appropriate.

Personnel should be held accountable for achieving their assigned goals. They should also be recognized for achieving goals and for actions performed in support of goals. Accountability and recognition should be administered in conjunction with the personnel performance appraisal system. Supervisor performance appraisals and promotions should include an assessment of operating performance.

4.3.1 Performance Standards

Performance standards should serve as the basis for accountable behavior. Personnel performance should be compared to performance standards to ensure consistency of accountability. Performance standards should be fostered by leadership example within the organization. Management should communicate new or revised performance standards to all personnel so that everyone understands and supports the standards. Benefits for exceeding performance standards should also be communicated.

Facility management should establish high performance standards for all activities. Management's expectations for the level of performance should be clearly defined in management policies, procedures, and directives. Management should require uniform adherence to these high standards, with safe, reliable facility operation being the primary goal. Management's day-to-day interactions with the work force should reinforce these performance level expectations. Facility activities should be conducted in a professional and businesslike manner.

Performance standards should be developed to ensure that:

- The professional conduct expected of personnel is specified and followed so that personnel performance coincides with the expectations of DOE and facility management

- Control area activities are conducted in a manner that achieves safe and reliable facility operation

- Normal and emergency communications are highly reliable, clear, and provide accurate transmission of information within the facility

- Facility operation by personnel under instruction is carefully supervised and controlled to avoid mistakes by unqualified personnel and to ensure that training time is used effectively

- An established and thorough review process exists so that all significant aspects of abnormal events are identified, investigated, and resolved

- Appropriate DOE personnel and other agencies receive timely notifications to ensure that the facility is responsive to public health and safety concerns

- Facility configuration is properly maintained by methods that control equipment and system status

- The lockout/tagout program provides protection to personnel and equipment, and aids in the control of equipment and system status

- The independent verification program ensures the reliability of designated operations and safety functions and aids in the control of equipment and system status

- The logkeeping program provides an accurate history of facility operations and aids in controlling equipment and system status

- Systematically performed turnovers provide on-coming personnel with an accurate status of their work stations

- Personnel understand unique processes and coordinate activities with process support personnel

- The required reading program enhances personnel awareness of important information relevant to their job assignments

- Operations management communicate, in writing, short-term information and administrative instructions to personnel in a timely fashion

- Operations procedures that direct the operation of the facility within its design bases are effectively used to support safe operation of the facility

- The operator aid program ensures that operator aids are current, correct, and useful

- The equipment and piping labeling program ensures that facility personnel are able to positively identify the equipment they operate.

Additional performance standards that enhance facility safety, quality, environmental protection, and production should be developed to support the mission of the facility.

4.4 Facility Resources

The operations supervisor should be responsible for identifying to DOE and corporate management the resources required for safe, reliable facility operation. The operations supervisor should also be responsible for providing lower-level managers with the resources to accomplish assigned tasks. The resources provided should include:

- Sufficient personnel to limit overtime

- Adequate permanent work areas to conduct facility activities

- Necessary spare parts and equipment to operate and maintain the facility

- Technical services in areas such as maintenance planning, engineering support, nuclear safety reviews, and interfacing with regulatory agencies

- Administrative services, including contract administration, budget and cost control, and personnel administration

- Personnel, facilities, and materials for training.

If a lack of resources compromises the ability to operate safely and efficiently within environmental, safety, and health requirements, the cognizant manager should take the necessary action(s) to correct the problem.

4.4.1 Human Resources

The facility should be staffed by competent personnel. A facility staffing plan, tied to the company's long-range goals, should be developed to anticipate future personnel needs. The plan should be reviewed periodically and updated to verify adequacy. Elements of this long-range plan should include anticipated changes in staffing levels, potential succession plans for key management positions, job rotation for developing professional and managerial experience, and a forecast of personnel needs, considering losses resulting from attrition. The long-range staffing plan should allow sufficient time for individuals to turn over job responsibilities and maintain continuity in performance.

Hiring should be regulated so that newly hired personnel meet the established minimum standards. The human resource group should emphasize retaining and developing employees. Personnel should understand management policies and goals concerning career progression, management and professional development activities, performance appraisals, and the compensation and reward system. Human resource policies and programs should be effectively communicated to all personnel and monitored periodically to determine their effectiveness. Managerial, supervisory, and technical skills should be developed through training, project assignments, and rotating job activities. Personnel performance should be evaluated through regular performance appraisals, and promotions should be based on performance and ability. Policies should be written to identify and deal with behavioral problems, including drug and alcohol abuse.

4.4.2 Material Resources

The facility should have sufficient material resources to conduct operations. Management should ensure that consumable materials (e.g., administrative supplies, oils, chemicals) are replenished to support facility operations and that nonconsumable materials (e.g., repair parts, new equipment) are available to minimize the impact on facility operations. In addition, management should ensure that all safety equipment required to perform operations (e.g., hearing protectors, chemical spill kits, eyewash stations, respiratory protection equipment) is available and ready for use.

4.5 Monitoring Operating Performance

Policies should be established to monitor operating performance with the primary goal of improving operations. To accomplish this, managers should be knowledgeable of

personnel performance, facility activities, and facility conditions within their areas of responsibility. Managers should be actively involved with the work activities under their cognizance to assess performance and reinforce management standards. Monitoring of facility activities should ensure that they are conducted according to appropriate standards, policies, and procedures, and that problems are promptly identified and corrected. There should be a high degree of management involvement and observation in day-to-day facility activities; a manager's routine should include frequent tours of the work place, including discussions with personnel. Monitoring by management should also include a program for monitoring facility performance through reporting and trending selected parameters. The monitoring program should provide operational data that are trended, analyzed, and forwarded to appropriate levels of upper management.

Managers and supervisors should clearly understand their responsibilities for setting a professional example and should monitor and correct problems related to failures to adhere to facility policies and procedures.

4.5.1 Management Tours

Each manager should plan periodic tours of facility areas as part of the manager's routine. Some of the criteria for establishing periodicity should include the risk associated with operations and the amount of operational activities occurring (i.e., tours of warehouses may be conducted less frequently than tours of production lines). Monitoring should include actual observations of work in progress. The practice of scheduling blocks of time for conducting such observations has proven effective.

Management tours should cover all areas, including hazardous and unmanned areas within the specific manager's purview. Tours should occur during all operating shifts. Besides observing personnel performing their specific jobs, managers should observe safety conditions and practices, radiological conditions and practices, material conditions, and housekeeping to ensure that expected standards are maintained. Before conducting a tour, managers may review lessons learned from in-house and industry operating experience so they can check to see if similar conditions or circumstances exist at their facility.

Deficiencies noted during tours should be documented and provided to responsible managers and supervisors for correction. If items are corrected during the tour, they should also be documented for information purposes. Followup tours should be carried out to ensure that timely and effective corrective action has occurred.

Routine activities that should be monitored include:

- Operational evolutions or work in progress to observe radiological protection and safety practices, procedural compliance, work habits, teamwork, and communications

- Shift turnovers in the control area and other work locations to observe formality, thoroughness, and continuity of activities

- Planning and scheduling

- Training activities (e.g., classroom, simulator, and on-the-job), including content, methods, and control.

Some non-routine activities that should be monitored include:

- Implementing new or revised procedures

- Coordinating actions in different locations, such as fire or other emergency preparedness drills for the facility

- Completion of maintenance activities or work by other areas for material condition, housekeeping, and cleanliness.

Management may assign other groups, such as quality assurance, to periodically monitor, audit, review and assess operating performance. These activities can assist managers and supervisors in identifying good and bad practices and correcting problems.

In addition to tours, other processes should be used to provide management with accurate information regarding facility performance, such as audits, reviews, investigations, and self-assessments. Details on investigations are contained in DOE Order 5480.19, Chapter VI, "Investigation of Abnormal Events."

The data obtained from the tours should be measurable. This information will be used to assess facility performance and to identify areas requiring management attention. Overall indicators used for facility performance, indicators to measure progress in achieving goals, and specific indicators for monitoring current performance problems and performance in specific functional areas should be selected. The data should be presented to indicate

trends, allow comparisons of actual versus expected results, and, where appropriate, show corrective actions and the results of these actions. Performance reports are a good way of presenting this information.

Performance reports should be issued regularly. Updating reports monthly has been most effective. Specific performance indicators should be analyzed for trends and early initiation of corrective action. A graphic format is preferable to compare actual results, facility goals, and overall industry progress over time. A management summary that highlights and explains reasons for undesirable trends (including problem areas, needed improvements, and actions taken to effect improvement) enhances the usefulness of the reports.

Responsibilities should be assigned for collecting and analyzing data for each indicator. A coordinator should be assigned responsibility for developing, producing, and distributing the report. Reports should be tailored to the particular needs of the appropriate recipient (e.g., contractor management, DOE representatives, and Federal, state, and local agency representatives).

Guidelines should be developed to determine which performance indicators apply to each level of management. For example, the operations supervisor's report could provide general performance indicators, other selected indicators, and an executive summary section noting unusual results and significant trends. A brief explanation of the causes of adverse trends and the corrective actions to be taken should also be provided. Reports to other managers should provide the information in the operation supervisor's report and other selected indicators applicable to their areas of responsibility.

Periodic reports addressing the status of programs and action items should also be developed. An integrated management information system may be used to provide the information for these reports. Items near completion should be monitored to ensure that due dates will be met. When items become overdue, they should be reviewed, appropriate actions taken, and the items rescheduled. Closeout methods should be streamlined to prevent completed items from being carried forward.

4.5.2 Management Assessment of Operating Performance

Management should assess good, as well as, bad operating performance. An assessment of good performance and positive trends should be evaluated to establish better operating practices throughout the facility. In addition, good

performance should be rewarded with positive feedback. An assessment of positive trends may lead to changing goals or accelerating existing goals.

Operating problems should be evaluated and corrective actions should be taken to improve the performance of operations. Undesirable performance trends noted either during management's monitoring tours or in reports should be assessed to determine root cause(s). Corrective actions can then be developed and implemented.

4.5.2.1 Corrective Actions

Corrective actions should address root causes instead of symptoms. Corrective action should be developed by appropriate personnel, including those tasked with implementing the actions. Facility line management should approve corrective actions and ensure implementation in a timely manner. Input from organizations, such as quality assurance, should be considered when determining actions in response to deficient conditions identified by these organizations. Management should track corrective actions to completion.

Appropriate managers and supervisors should be held accountable for timely and effective implementation of corrective actions. Delays in completing approved corrective actions should be reported to the manager who assigned the actions. An escalation process will provide attention from higher levels of management to problem areas for which corrective action continues to be ineffective.

4.5.2.2 Followup on Effectiveness of Corrective Actions

Followup on the effectiveness of corrective actions is an integral part of management's monitoring program. Followup monitoring should determine if the immediate condition has been corrected and the root cause(s) eliminated. This may require monitoring the immediate corrective actions, followed by subsequent monitoring to determine whether recurrence of the condition has been eliminated. Depending upon the results of followup monitoring, the item can be closed or new corrective actions formulated.

4.6 Management Training

Management training and professional development should be conducted to ensure the facility is staffed by highly capable and experienced individuals. This training should enhance the managerial and technical skills of facility personnel, such as written and oral communications and specialized technical subjects. The unique needs for each level of management and for each individual should be considered in the management development program.

Management should assess the management needs of the facility and define job prerequisites, including necessary training, experience, professional certifications, and skills development. Criteria should be established for selecting personnel to participate in management development. The training and job rotation assignments that constitute management development activities should be defined and communicated to participating personnel. Adequate resources should be available to support the training and career-broadening assignments necessary for developing personnel.

A major goal of the management development effort should be to have qualified personnel in the facility organization ready to be promoted to the next level of management.

4.7 Planning for Safety

Facility management and personnel should assume direct responsibility for conducting activities and functions in a manner that emphasizes safety and minimizes the potential for challenges to safety limits and personnel exposure. When unexpected conditions that are outside the scope of normal conditions arise, personnel should always exercise conservative judgment and obtain management guidance, as appropriate, before proceeding.

4.7.1 Planning

Each facility should have guidelines that describe safety planning requirements for all operational activities. These guidelines should explain the role of safety analysis reports (SARs), job safety analyses (JSAs), and the handling of safety matters. Operational activities should be reviewed to ensure that they address safety planning. This review may be conducted by a formal safety review committee, which will ensure that all aspects of safety, including local, state, and Federal requirements, are properly addressed. The accompanying documentation should identify personnel protective equipment, system alignments, and operator qualifications needed for safe operation.

Safety planning should occur as part of the work planning process. If SARs and JSAs exist, they should be used in planning. If an SAR or JSA does not exist, performing one or both may be useful to determine the safety and health risks present at the facility or for a given job. These two tools will help when determining safety and health risks for existing, new, or modified facility operations.

4.7.2 Training

All operations personnel should understand safety planning requirements. Therefore, all personnel should be trained to incorporate safety planning into their job routines. Training should include a discussion of the importance of safety planning, methods of safety planning, and the requirements.

SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter VI, "Investigation of Abnormal Events."

DOE G 450.4-1, *Integrated Safety Management System Guide*.

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CONCLUDING MATERIAL

Review Activities:

DOE
DP
EH
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NE
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Preparing Activity:

DOE-EH-31

Project Number:

MISC-0004

TS

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December 1992

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December 1998

DOE STANDARD

GUIDE TO GOOD PRACTICES FOR OPERATIONS AND ADMINISTRATION UPDATES THROUGH REQUIRED READING

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

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Guide to Good Practices for Operations and Administration Updates Through Required Reading

Page/Section	Change
p. 10 / Section 4.4	References to DOE Order 1324.5, *Records Management Program*, and DOE Order 1324.2A, *Records Disposition* were replaced by DOE G 1324.5B, *Guide for DOE Records Management.*
p. 11 / Supplemental Resources	References to DOE Order 1324.5, *Records Management Program*, and DOE Order 1324.2A, *Records Disposition* were replaced by DOE G 1324.5B, *Guide for DOE Records Management.*
Concluding Material	The Preparing Activity was changed to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

KEYWORDS

File Index
Immediate Reading Document
Required Reading File

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APPENDIX A
   REQUIRED READING DOCUMENT LOG A-1

APPENDIX B
   REQUIRED READING SIGN-OFF MATRIX B-1

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DEFINITIONS

File Index	A listing of the types of documents that should be designated for required reading.
Immediate Reading Document	A document that must be read before assuming responsibility for a job position or performing an activity affected by that document.
Required Reading Document	A document identified by an appropriate level of management for reading by designated personnel.
Required Reading File	A binder containing documents required to be read by a certain date.

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GUIDE TO GOOD PRACTICES FOR REQUIRED READING

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Required Reading, Chapter XIV of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The practices in this guide should be considered when planning or reviewing programs for updating personnel with operations and administration information through required reading. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Required Reading" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for a coordinated required reading program to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

A required reading program is in place to enhance personnel awareness of important information relevant to their job assignments.

Criteria:

a. A list of the types of documents to be selected for required reading is developed.

b. A system is in place that specifies documents to be read by applicable personnel, whose operations are impacted by such documents.

c. Required reading documents are assigned a required completion date.

d. Completion of reading assignments is documented and that documentation is retained.

e. Periodic reviews are performed to ensure required completion dates are met.

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3. DISCUSSION

A properly administered program for updating personnel with operations and administration information through required reading is essential to the safety of personnel, equipment, and the environment. Required reading provides a method for employees to be made aware of information related to their job assignments. It incudes information such as lessons learned from industry operating experience, facility equipment and system changes, procedure changes, company policies, and human resource information. A required reading program can also supplement employee training by providing information that is not routinely included in a formal training program or information that may be trained on at a later date. The decision on how the required reading program will be used in conjunction with the facility training program must be carefully considered for each reading assignment. The system used to enact the required reading program provides tracking of the information supplied to employees and the completion status of the reading assignments. Personnel should be informed of the importance of questioning any information received through required reading when it is not understood.

Essential to an effective required reading program is the administrative procedure governing the program. This procedure provides the necessary guidance to the manager or supervisor responsible for administering this program. The information herein will assist in the development of such a program.

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4. GOOD PRACTICES

A required reading program that contains the following elements will enhance personnel knowledge and awareness, and hence enhance the safety and operations of any DOE facility.

4.1 File Index

The file index is a management aid for screening documents to ensure appropriate information is placed in the required reading file. It incorporates types of documents that provide information that affect the operation of the facility. In addition, it should include the types of documents that require formal documentation that the information has been read. Examples of the types of documents to include in a file index are:

- Procedure changes or revisions
- Temporary modifications to systems or equipment
- New or updated hazard communication information
- Company reference manual changes
- Policy changes
- Related industry event reports
- Occurrence reports
- Industry operating experience information
- Other information necessary to keep operations department personnel aware of current area activities.

The appropriate manager or supervisor should develop the file index and include it in the administrative procedure governing the required reading program.

4.2 Reading Assignments

The appropriate manager or supervisor should assign employees to read only documents that pertain to them. Avoid the tendency to require all personnel to read all documents selected for required reading just because they work for the same organization. This will maximize program worth by maintaining personal interest in the reading assignments. For example, a document summarizing a recent occurrence may need to be read by all personnel; however, a change to a company policy regarding hazardous chemical use may not.

Required reading documents should be kept in the required reading file. This file should be placed in an accessible location (e.g., the cognizant manager's office or desk, for shift work the shift supervisor's office or desk) that allows personnel to retrieve and read the documents. In special cases, it may be desirable not to place some documents in the required reading file because of their size or for other reasons (e.g., classification). When a required reading document is not placed in the file, the required reading document log or a required reading sign-off matrix (see appendices) should indicate the location of the document.

4.3 Required Dates for Completing Reading Assignments

The appropriate manager or supervisor should assign a required completion date to the required reading document. When determining the date, the relative importance of the information to the employees should be taken into account. Some documents should be designated for immediate reading while others may be designated for general reading.

Examples of immediate reading documents include:

- Temporary modifications to a system

- Procedure change

- New or updated hazard communication information.

When documents are designated for immediate reading, a notification that the document has been issued should be placed in the timely orders to operators. Operator orders provide a means for management to communicate guidance and short-term information to personnel. For more information on timely orders, refer to DOE Order 5480.19, Chapter XV, *Timely Orders to Operators*.

General reading documents may have long-term or recurrent required completion dates, such as an annual requirement to review the company policy manual. In all cases, personnel are responsible to read the required reading assignments within the timeframe specified.

4.4 Documentation

Personnel should document the completion of reading assignments by signature or initials. The documentation used should list the document title or description, required completion date, actual completion date, and a signature or initials verifying the completion of the reading assignment. The type of documentation used depends on the level of management responsible for tracking the required reading program. If the appropriate level of management is responsible for a multi-level organization, such as an Operations Manager responsible for five operating shifts, then the documents described in Appendix A could be used. If the appropriate level of management is at a smaller scale, such as a first line supervisor responsible for fifteen people, then the documentation described in Appendix B could be used. One additional method for documenting completion and tracking of required reading would be to use a computer-based system.

Documentation that reading assignments have been completed should be retained. The retention of documents is controlled by DOE G 1324.5B, *Guide for DOE Records Management.*

4.5 Review

The appropriate manager or supervisor should periodically review the required reading file to ensure completion of reading assignments by the required completion date. One method of formally accomplishing this is by using a review sheet in the required reading file. The sheet should specify the review frequency (e.g., monthly, quarterly) and provide spaces for the reviewer's signature and date of review. Another method, which is similar to that used when reviewing log books, would be to document the review on the required reading document log (see Appendix A).

Completed required reading documents should be removed from the required reading file and retained for reference (i.e., kept in a "dead" file). If the document will ultimately become part of a permanent record (e.g., procedure, company policy), then the document need not be retained.

SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XV, "Timely Orders to Operators."

DOE G 1324.5B, *Guide for DOE Records Management*.

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APPENDIX A

REQUIRED READING DOCUMENT LOG

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REQUIRED READING DOCUMENT LOG

The following system can be used by an organization at any level. The administrative procedure governing the required reading program should prescribe the use of this system and its supporting forms.

An advantage of using this type of system is the ability to track several different groups of employees. An effective use of this system and forms is described as follows:

[1] The appropriate manager shall:

[a] Assign documents for reading by his staff as required reading.

[i] Determine a completion date for the document. The completion date should be based on the urgency of the document.

[b] Complete a sign-off sheet (page A-5).

[i] Record the assignment group (e.g., shift crew, administration), document title or description, required completion date, and the employee names. (Assignment groups and employee names may be preprinted on the forms.)

[ii] Record "NA" (Not Applicable) and initial in the completion date block, for a document not required to be reviewed by that particular employee.

[iii] Indicate where the document is located if it was not placed in the required reading file.

[c] Record the document title or description, assignment group, and the required completion date on the required reading document log (page A-7).

[d] Place the document and sign-off sheet in the appropriate section of the required reading file. For those documents that will not be placed in the file, place the sign-off sheet in the appropriate section of the file.

[e] Record the completion date and the supervisor's initials on the required reading document log and discard the review sheet after the reading assignment has been completed by all affected employees.

[2] Retain the required reading document log in accordance with document control procedures after it has been completely filled in.

EXAMPLE SIGN-OFF SHEET

Assignment Group

Document Title or Description

LOCATION:

Required Completion Date _____

EMPLOYEE NAME	COMPLETION DATE	INIT	COMMENTS

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REQUIRED READING DOCUMENT LOG

DOCUMENT TITLE OR DESCRIPTION	ASSIGNMENT GROUP	COMPLETION DATE REQ'D	ACTUAL	SUPV INIT	COMMENTS
Company Safety Manual, Chptr. 3,	All Empoyees	10/10/92	10/9//92	*JCS*	Deleted.
Maintenance Instructions	Maint. Personnel	10/26/92	10/26/92	*JCS*	Deleted
Emergency Plan	All Employees	11/16/92	11/15/92	*JCS*	Deleted
Reviewed Joe C.	**Smithe 12/29/92**	**No**	**comments.**		
Safety Note 23	All Employees	1/6/93	1/6/93	*JCS*	Dead filed.

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APPENDIX B

REQUIRED READING SIGN-OFF MATRIX

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REQUIRED READING SIGN-OFF MATRIX

The following system could be used by a small organization. The administrative procedure governing the required reading program should prescribe the use of this system and its supporting forms.

The advantage of this type of documentation system is that the retained forms verify the completion of reading assignment by each affected individual. An effective use of this system and form is described as follows:

[1] The appropriate manager shall:

[a] Assign documents for reading by his staff as required reading.

[i] Determine a completion date for the document. The completion date should be based on the urgency of the document.

[b] Record the document title or description, required completion date, and employee names on the sign-off matrix (page B-5). (Employee names may be preprinted on the form.)

[c] Record "NA" (Not Applicable) and initial in the completion date block, for a document not required to be reviewed by that particular employee.

[d] Place the document in the appropriate section of the required reading file. For a document that will not be placed in the required reading file, indicate where the document can be located.

[2] Retain the completed sign-off matrices in accordance with document control procedures.

REQUIRED READING SIGN-OFF MATRIX

REQ'D COMPLETION DATE / DOCUMENT TITLE OR DESCRIPTION	LOCATION:	LOCATION:	LOCATION:	LOCATION:	LOCATION:	LOCATION:	LOCATION:	LOCATION:	LOCATION:	LOCATION:	
EMPLOYEE NAME											COMMENTS

NOTE: Complete Reading Assignments and Record Actual Completion Date and Initials (e.g. 6/7/92 JDS)

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CONCLUDING MATERIAL

Review Activities:

DOE
DP
EH
EM
ER
NE
NS

Preparing Activity:

DOE-EH-31

Project Number:

MISC-0005

TS

NOT MEASUREMENT SENSITIVE

DOE-STD-1034-93
March 1993
CHANGE NOTICE NO. 1
December 1998

DOE STANDARD

GUIDE TO GOOD PRACTICES FOR TIMELY ORDERS TO OPERATORS

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

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Guide to Good Practices for Timely Orders to Operators

Page / Section	Change
p. 10 / Section 4.3	The references to DOE Order 1324.2A and DOE Order 1324.5B were updated to reference DOE Guide 1324.5B.
p. 11 / Supplemental Resources	The references to DOE Order 1324.2A and DOE Order 1324.5B were removed. The reference to DOE Guide 1324.5B was added.
Concluding Material	The Preparing Activity was updated to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, "Conduct of Operations Requirements for DOE Facilities."

KEYWORDS

Daily Orders
Long-Term Orders
Operator Orders Book

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DEFINITIONS

Cognizant Manager	The individual having authority and responsibility for control of a facility, process, experiment, or other project.
Daily Orders	Orders whose information is relevant to that day's (or two days) operations.
Long-Term Orders	Orders whose information is relevant to several days, weeks, or months operations.
Non-routine Operations	Special, short-term, or one-of-a-kind activities that are not performed as part of a normal routine.
Operator Orders Book	A binder or logbook containing the current operator orders.

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DOE-STD-1034-93

GUIDE TO GOOD PRACTICES FOR TIMELY ORDERS TO OPERATORS

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Timely Orders to Operators, Chapter XV of Department of Energy (DOE) Order 5480.19, "Conduct of Operations Requirements for DOE Facilities." The practices in this guide should be considered when planning or reviewing Timely Orders to Operators programs. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Timely Orders to Operators" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for timely orders to operators to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

A program is in place for operations management to communicate, in writing, short-term information and administrative instructions to personnel in a timely fashion.

Criteria:

a. Operator orders are clearly written, dated, and maintained in an accessible location.

b. Operator orders are issued by the cognizant manager to communicate pertinent and relevant information to personnel.

c. Operator orders are segregated into daily and long-term orders.

d. Appropriate personnel periodically review operator orders and document their review.

e. Operator orders that are no longer applicable or are outdated are removed or cancelled by the cognizant manager.

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3. DISCUSSION

Management often finds it necessary to provide written guidance and direction to employees, such as outlining activities during periods of maintenance or providing notice of an immediate document review located in the required reading file. This guidance needs to be provided in a formal and timely manner. Operator orders are designed to provide a means for management to communicate guidance and short-term information to personnel. They may be used whenever it is necessary to disseminate information to personnel concerning special operations, administrative details, or environmental, safety, and health issues, but should never be used to replace or change facility procedures.

Establishing an administrative policy or procedure which specifically addresses the requirements for content, format, issuing, segregating, reviewing, and removal of timely orders will ensure the process is standardized throughout the facility. Such a policy should provide managers and supervisors an effective means to communicate appropriate guidance and information in a timely manner. Other means of routinely communicating guidance to employees are addressed in DOE Order 5480.19, Chapter XIV, "Required Reading"; Chapter XVI, "Operations Procedures"; and Chapter XVII, "Operator Aid Postings."

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4. GOOD PRACTICES

A Timely Orders to Operators program that uses the following guidance will enhance the safety and reliability of operations at any DOE facility.

4.1 Content and Format

4.1.1 Content

Operator orders should be issued whenever it is necessary to communicate short-term information related to the conduct of facility business. They may be used in either shift or daily work environments, but specifically when there is a need to provide direction or information to work-force personnel in the absence of cognizant management. Examples of the types of information to include in operator orders are:

- Notification of work priorities
- Special operations
- Non-routine tests
- Data collection programs
- Upcoming events and audits
- Announcements of administrative items, policies, procedure changes, or specific activities

- Notice of documents requiring immediate review in the Required Reading File.

The information in operator orders should not conflict with or change procedures; however they may be used to notify personnel of a procedure change or revision, or issuance of a new procedure. DOE Order 5480.19, Chapter XVI, "Operations Procedures" provides guidelines for the development, approval, revision, and use of procedures.

4.1.2 Format

Operator orders should be clearly written and dated. They should include the length of time the order is to be applicable or a cancellation date. Provisions should be made to document review by appropriate personnel. Examples of daily and long-term orders are shown in Appendix A.

4.2 Issuing, Segregating, and Reviewing Operator Orders

4.2.1 Issuing Operator Orders

The cognizant manager is responsible for issuing operator orders to personnel. Orders should be issued as necessary and updated on a daily basis. The orders should be issued as either daily orders or long-term orders. Daily orders contain information such as the announcement of a procedure change or direction for a non-routine process. They usually contain action items which will take place: on the remaining portion of the day, the following day, or weekends and holidays. Daily orders may be renewed by the cognizant manager when necessary. Long-term orders contain information such as a time-line of work activities during a maintenance period. When long-term orders are issued, a notice should be placed in the daily orders.

4.2.2 Segregating Operator Orders

The orders should be placed in an operator orders book. This book should be maintained in a designated location for easy access. The operator orders book should be divided into two sections: daily orders and long-term orders. Daily orders include those that should be completed within one or two days. Long-term orders include orders that may take several days or longer to complete. As a general rule, orders in effect for an extensive period of time should be incorporated into a procedure or company policy.

4.2.3 Reviewing Operator Orders

Daily orders should be reviewed by the appropriate individuals early in the work period prior to starting or resuming any affected activity (e.g., at shift change). This review should be documented by signature or initials. Long-term orders should be reviewed periodically or when changes occur. It is a good practice to have supervisors review daily and long-term orders during daily briefings to ensure that the information in the order is disseminated to all personnel. For guidance on shift briefings, refer to DOE Order 5480.19, Chapter XII, "Operations Turnover."

The cognizant manager should be notified when action items are complete. When operator orders are postponed or delayed, the cognizant manager should be notified.

4.3 Removal of Operator Orders

The cognizant manager should review the operator orders book periodically to ensure that it only contains current orders. A good management practice is to review the book monthly. Operator orders that are no longer applicable should be

removed or cancelled. These orders may need to be retained for reference. For guidance on the retention of documents, refer to DOE-G-1324.5B, "Guide for DOE Records Management."

SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XII, "Operations Turnover."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XIV, "Required Reading."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XVI, "Operations Procedures."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XVII, "Operator Aid Postings."

DOE-G-1324.5B, *Guide for DOE Records Management*.

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APPENDIX A

EXAMPLE OPERATOR ORDERS

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EXAMPLE DAILY ORDER

		Initial/date after Review:
		Allen ___/_____
To:	**All Supervisors**	Johnson ___/_____
From:	**Area Manager**	Jones ___/_____
Duration:	**Jan. 17, 1992 at 5:00 pm to**	Pratt ___/_____
	Jan. 18, 1992 at 5:00 pm	Smith ___/_____
		Turner ___/_____

Daily Orders

1. A copy of a new procedure has been placed in the Required Reading File: OP-EV-0082, *Pumping Out Evaporation Pit, 101-C*. Ensure all applicable personnel have reviewed this procedure prior to performing the evolution or shift completion.
2. **JONES** - Lock out No. 1 air compressor in 101-1A per lockout order OP-92-531 for overhaul to be ready to work 1/18/92 at 7:30 am.
3. A shipment of low level waste (LLW) is expected during second shift. After receipt, begin characterization of waste for emplacement. Contact the Operations Manager if shipment has not arrived by 6:30 pm.
4. Review long-term orders. A new order outlining the work activities for the upcoming maintenance period is in effect.

General Information:

1. See attached 1/13/92 Safety Committee meeting minutes. Post in Briefing Room and Lunchroom.

Quality

Attention to Detail. We must pay attention to detail during our monitoring of equipment. This often means going beyond simply taking the data. It means being inquisitive, looking for problems before they arise, and observing all indications. By paying attention to detail, we can significantly reduce the number of potential problems.

EXAMPLE LONG-TERM ORDER

Initial/date after Review:

Allen ___/_____

Johnson ___/_____

Jones ___/_____

Pratt ___/_____

Smith ___/_____

Turner ___/_____

To: **All Supervisors**

From: **Area Manager**

Date: **January 17, 1992**

Cancellation Date: __2/15/92__

Long-Term Orders

1. The first quarter maintenance period begins 1/20/92 and is scheduled to end on 2/14/92. Review the attached work schedule. Daily briefings will be held at the beginning of each work period throughout the maintenance period. The daily briefings will be held in Bldg. 101 conference room. All work groups involved in the maintenance must attend. At 7:00 am each day, all supervisors will meet in Bldg. 101 conference room and submit a written status report.
2. Transuranic (TRU) waste is no longer being accepted due to current state litigation proceedings. If a TRU waste shipment arrives DO NOT RECEIPT THE SHIPMENT, CONTACT THE OPERATIONS MANAGER IMMEDIATELY.
3. See revised training schedule for January (attached). Post in Bldg. 101 and distribute copies to all personnel. All personnel should know when they are scheduled and should attend as scheduled.
4. Continue measuring conductivity of potable water (PW) as requested by Engineering. These measurements will be used for determining the best instrument to measure conductivity in the PW system. Our effort now will help us in the future by having reliable instruments!

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DOE-STD-1034-93

CONCLUDING MATERIAL

Review Activities:	**Preparing Activity:**
DOE	DOE-EH-31
DP	
EH	**Project Number:**
EM	
ER	MISC-0006
NE	
NS	

TS

NOT MEASUREMENT SENSITIVE

DOE-STD-1035-93
March 1993
CHANGE NOTICE NO. 1
December 1998

DOE STANDARD

GUIDE TO GOOD PRACTICES FOR LOGKEEPING

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

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Guide to Good Practices for Logkeeping

Page / Section	Change
p. 13 / Section 4.7	The references to DOE O 1324.5 and DOE O 1324.2A were updated to the current document—DOE G 1324.5B.
p. 14 / Section 4.8	This section was added.
p. 15 / Supplemental Resources	The references to DOE O 1324.2A, DOE O 1324.5, and DOE O 5000.3B were removed.
p. 15 / Supplemental Resources	The references to DOE G 1324.5B and DOE O 232.1A were added.
Concluding Material	The Preparing Activity was changed from NE-73 to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, "Conduct of Operations Requirements for DOE Facilities."

KEYWORDS

Log
Narrative Log
Round Sheet

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DEFINITIONS

Log (Narrative Log)	A chronological narrative record of events or functions.
Operations	The business activity of the facility and assigned personnel, e.g., controlling process equipment, producing/assembling components, performing tests, conducting experiments, processing information, etc.
Round Sheet (Round Inspection Sheet)	A type of data collection sheet used to record key equipment and system parameters (e.g., readings from instruments and gauges) and operating status (whether operating or shutdown for maintenance or repair) during equipment inspection tours (rounds).
Shift	The normal period of work for an individual or group, e.g., 8:00 a.m. to 5:00 p.m.

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GUIDE TO GOOD PRACTICES FOR LOGKEEPING

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Logkeeping, Chapter XI of Department of Energy (DOE) Order 5480.19, "Conduct of Operations Requirements for DOE Facilities." The practices in this guide should be considered when planning or reviewing logkeeping programs. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Logkeeping" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the need for a consistent logkeeping program to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

A logkeeping program is in place to provide an accurate history of facility operations and to aid in controlling equipment and system status.

Criteria:

a. Logs are established for key shift positions.

b. Written guidance defines the type, scope, and format of entries for each log.

c. Information is recorded in logs in a timely manner.

d. Log entries are precise, legible, and easily understood by the reader.

e. A standardized method is used for correcting errors in logs.

f. Supervisors periodically review logs for accuracy and adequacy.

g. Written guidance is provided for the disposition of completed logs.

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3. DISCUSSION

This guide has been prepared to aid facilities and individuals in maintaining logs, both as working documents used in the daily conduct of facility operations and as permanent legal records.

The guidelines of DOE Order 5480.19 identify logs as part of the overall program for controlling equipment and system status. Logs have many characteristics in common with round sheets, in that both provide information concerning the condition and status of equipment, and both are treated as legal records. Round sheets normally record only data collected from instruments. Logs are used to record an understandable account of the changes in the status of equipment, information obtained from sources in addition to instruments, and explanations for unusual data readings. This information makes logs a valuable tool in reconstructing events. If an unusual event occurs, its precursors and its progress can often be traced by analyzing logs, round sheets, and other records.

Logs provide a method for transferring information from one person or shift, to another, and are an important part of the operations turnover described in DOE Order 5480.19, Chapter XII. The transfer of information through logs enables current personnel to benefit from the experiences of previous operators of the equipment. The record of problems and attempted solutions may be reviewed whenever a new or similar problem occurs. The lessons learned can save time and effort in the search for solutions to current problems, and can help personnel avoid situations that caused problems in the past. The information contained in logs is also often used by engineers to track the performance of components or processes, by training personnel to provide examples for instruction, and by others requiring specific information concerning operations.

Logkeeping enhances the formality that must be a part of good operating practices and encourages individual accountability for operating decisions and actions. Logkeeping may also reduce paperwork by providing a single location and format for documenting operating activities.

DOE Order 5480.19 recommends logs for all key shift or process operator positions. Since logs are regarded as legal documents, they should meet high standards for accuracy and consistency. Facility guidelines should specify the positions required to maintain logs, the type of information to be recorded, and the requirements for format, timeliness, and legibility. Facility guidelines should also provide instructions for correcting errors in logs, periodic review of logs, and disposition of completed logs.

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4. GOOD PRACTICES

4.1 Establishing Operating Logs

Narrative logs should be an accurate history of facility operations. Logs should be established and maintained for all key positions (e.g., supervisors, control area operators, operators of isolated or remote equipment, etc.), including positions that are filled only on a part-time basis (e.g., test coordinator, wastewater treatment operator, or emergency equipment operator). When a narrative log is not maintained for a particular position, a narrative section should be provided on round sheets. If used, the narrative section should be maintained in accordance with the guidelines for logs. An example of a narrative log is shown in Appendix A.

Some facilities maintain additional logs for specific items of equipment (e.g., emergency generators). These logs provide an equipment history, and usually record activities and information relating to both operations and maintenance. Facilities or regulatory agencies may also require additional logs for specific processes (e.g., wastewater treatment and discharge). These additional logs should adhere to the requirements for narrative logs.

Facilities should develop written guidelines to ensure consistency in maintaining logs. The guidelines should address:

- Shift positions, processes, or equipment that require logs
- Personnel authorized to make entries in logs
- Standards for information to be recorded in logs
- Format requirements for logs and log entries
- Review requirements for logs
- Instructions for control of logs and disposition of completed logs.

The following sections of this guide provide information to assist facilities in the development of these guidelines.

4.2 Information to be Recorded

Each facility should provide written guidance defining the type and scope of information to be included in the logs. Log entries should be concise, yet contain sufficient information to allow accurate reconstruction of events. During emergencies and abnormal or unexpected events, logkeeping should not take precedence over controlling the facility; however, it is important that as much significant information as possible be included in the log. Entry of information into the log should not be regarded as a substitute for reporting to supervisors or other required reporting.

Log entries need not duplicate information recorded in other permanent records, such as round sheets or logs for other shift positions. However, any information that is of operational interest should be recorded in at least one facility log. If the operator is in doubt as to whether the information must be recorded, it is usually better to record. The following subsections identify categories of information that should be recorded in logs.

4.2.1 Changes in Facility or Equipment Status

Any change in the status or operating mode of equipment, systems, and processes (e.g., startup, shutdown, depressurizing, preheating, etc.) should be recorded in the log. The log should identify the specific procedure, or portion of a procedure, that is used. The initiation and completion of required surveillance or operational testing, and verification of status for safety-related equipment should also be recorded.

4.2.2 Abnormal Configurations

Occasionally a facility or system must be operated in an abnormal configuration to support maintenance or testing, or to respond to emergency conditions. Examples of abnormal configurations include: electrical or hose jumpers installed to bypass certain components or functions, blocked or locked-out safety channels or instrumentation, intentionally plugged drains, pinned or blocked check valves or other flow-control devices, or power supplied from an alternate source. When equipment is placed in an abnormal configuration, the reason (e.g., maintenance, testing, inoperability of normal equipment), authority for doing so (e.g., procedure, supervisor instruction), expected duration, and any special precautions should be recorded in the log.

4.2.3 Entering/Exiting Technical Safety Requirements

Any time facility conditions justify restricted operations in accordance with technical safety requirements, an entry to that effect should be made in the log. Another log entry, recording the elapsed time under technical safety requirement restriction, should be made when operations return to normal. Logging these events serves as an aid to the operator on shift, emphasizing the importance of the technical safety requirements, as well as documenting compliance with regulatory and safety limitations.

4.2.4 Out-of-Specification Readings

During operator rounds, the log can serve as a supplement to the round sheet by providing space for narrative comments on the condition and status of the equipment. Any out-of-specification reading or indication should be explained in the log. The log may also be used to record both objective and subjective observations regarding the condition of the equipment. Subjective observations, such as abnormal noise, vibration, odor, humidity, dust, temperature, etc., often enable qualified operators to identify problem precursors before process parameters exceed their permissible limits.

Log entries documenting abnormal observations or readings should include a description of the abnormal condition, the corrective actions and notifications made by the operator, and the cause of the condition, if it can be determined. Whether or not the abnormal condition can be corrected by the operator, the log entry will alert other operators to the potential problem. The log entry also preserves the operator's first-hand observations and reactions in the event a more comprehensive investigation is required. The sample log in Appendix A illustrates entries (Notes 5 and 8) for problems or out of specification conditions discovered by the operator.

4.2.5 Occurrence of Reportable Events

The occurrence of any event that is reportable outside the immediate operating group or shift should be recorded in the log. Log entries for reportable events should identify the person(s) notified, the time(s) of notification, and the actions taken by the operator to correct the event or condition. Events and conditions that are reportable to DOE are identified in DOE Order 232.1A, *Occurrence*

Reporting and Processing Operations Information. Other federal, state, and local agencies, or other site organizations may have additional reporting requirements.

4.2.6 Security Incidents

If a security incident occurs, or if there is reason to suspect that one has occurred, the individual should report the discovery in accordance with facility procedures. The circumstances of the discovery and any other information known about the incident should be recorded in the log. This information will be useful both for the security investigation of the incident and for determining the effect the incident may have had on operations. Security incidents may include discovery of improperly controlled classified material or documents, unauthorized or unknown persons in the area, and missing or damaged government property.

4.2.7 Shift/Personnel Relief

The assumption of responsibility for a shift position should be recorded in the log. This occurs at shift turnover, and may occur at other times during a shift. The log should identify the oncoming relief person by name, and should document the time of this person's acceptance of responsibility. Additional information describing the content and format of log entries for shift or personnel relief is given in Section 4.4.2, Initial Entry, and Section 4.4.4, Final Entry.

4.3 Timeliness of Recordings

Information should be recorded promptly in the log to ensure accuracy and completeness, but logkeeping should not take precedence over controlling or monitoring the facility. All events should be recorded in chronological order. If there is a delay between the time of the occurrence and recording it in the log, the log entry should include the actual time of the occurrence.

If an individual has failed to make a log entry at the proper time, and has since made additional entries, the late entry should be recorded in the next available space. The entry should indicate the actual time of the occurrence and should be identified as a late entry. A reference mark or notation may be placed in the margin, indicating that an entry has been omitted and is entered later in the log. The sample log in Appendix A (Note 11) includes an example of a late entry.

4.4 Legibility and Format

Maintaining logs as both working documents and permanent legal records requires precautions to preserve the physical integrity of the log. Logs should be maintained in a hard-bound ledger with numbered pages, or in a duplicate-type book with numbered pages. Waterproof black ink is recommended for all logkeeping.

Facilities should provide a method for identifying the persons who make entries in the log. One method is to list the printed name, signature, and initials of all persons making log entries. This may be done as part of the initial entry, or on a separate page or form maintained with the log.

Entries in the log should be easy for others to read and understand. All persons maintaining a log should ensure that their handwriting can be easily read by others. The language and style of writing should be in keeping with the intent of a narrative record of operation; language should be similar to the language one would use if describing the events to another operator or supervisor. Acronyms and abbreviations should come from an approved list.

Log entries should be reproducible on standard photocopy machines. If colored ink or highlight pens are used to draw attention to entries, a check should be performed to ensure that the log text is not obscured, either in the original or when copying.

Detailed instructions for log format should be contained in facility guidelines. The following subsections, and the example log entries in Appendix A, contain information that may be helpful in developing the facility guidelines.

4.4.1 General Format

It should be difficult or impossible to alter or add to the entries contained in the log. All lines on the page should be used, or marked in a manner that designates them as not used. As a good practice, lines should not be skipped between or within entries. Unruled spaces on the log page (e.g., the margin at the top of the page) should not be used for log entries.

The date should be recorded on each page. Entries should be formatted so that a person reading the log can determine at a glance the date and time of the entry.

4.4.2 Initial Entry

An initial entry should be made in the log at the beginning of each shift. The initial entry should be dated, should acknowledge the assumption of responsibility, and should contain the signature of the person assuming the shift position. Some facilities require a more detailed entry on a daily or per-shift basis summarizing plant conditions, equipment status, and work in progress. Examples of initial entries are shown in Appendix A (Notes 4 and 12).

4.4.3 Incomplete Tasks

The events recorded in the log may require followup action by the person keeping the log. If the action cannot be performed immediately, because of plant conditions or higher priority tasks, an entry should be made in the log to identify the task as incomplete. This is a way of reminding the person keeping the log, or the person who will fill the position on another shift, that the required action has not yet been performed. The sample log in Appendix A contains an entry identifying an action that must be completed on a later shift. (See entry for 05/15/92, 1910.)

4.4.4 Final Entry

The offgoing operator or supervisor should make a final log entry when relieved by another person or at the end of the shift. The final entry should indicate the name of the relief person (if the position is relieved through a turnover), and should be signed by the offgoing individual to authenticate the entries made during the shift. Examples of final log entries are contained in Appendix A (Note 3).

4.5 Correcting Errors

Facility guidelines should identify a standardized method for correcting errors in all operating records, including logs. The method of correction should not obscure or cover up the original entry; erasing or use of "white-out" should not be permitted. Treating the logs as legal records means that all entries must remain readable. If a correction is erroneously made, vital information could be destroyed unless the method of correction preserves the readability of the original text.

If the person keeping the log makes an error, a correction can be made by placing a single line through the incorrect information and writing the correct information in a nearby space.

The correction should be initialed and dated. An example of this method of correction is shown in Appendix A (Note 7).

When an error is discovered by someone other than the person who made the entry, the person making the discovery should not change the original entry. A new entry should be made in the log at the time of discovery to indicate that an error has been identified. The new entry should include the date and time of the incorrect entry and the incorrect information, and should clearly state the correct information. A note in the margin at the location of the incorrect entry, giving the date and time of the new entry, can be used to inform personnel that an error has been identified. Appendix A (Notes 10 and 13) contains an example of an entry to correct a previous error.

4.6 Log Reviews

At the beginning of each shift, the oncoming personnel should review the log entries since their last shift (or for a time period specified in facility guidelines). This review will familiarize personnel with recent changes in the status of equipment and bring them up to date on current processes or activities.

Supervisors should review the logs of subordinates during each shift. This review enables the supervisor to ensure that the entries are accurate and adequate. It also provides the supervisor with an additional perspective on the operation, since detailed equipment observations are more likely to be included in individual logs. The supervisor should document each log review. One method is to make an entry directly in the log at the time of review. Appendix A (Note 9) illustrates this.

Logs should also be made available for review by persons outside the operating organization. For example, system engineers and maintenance engineers can use operating logs to help detect potential problems in the equipment or procedures. Training personnel can use logs to develop instructive examples that accurately reflect facility operations or problems.

4.7 Storage of Completed Logs

Completed logs should be retained in or near the operating area for a sufficient time to permit review by operators returning to work after extended absences.

Each facility should establish written guidance for storing completed logs after they have been reviewed. Logs should be stored in a manner that will preserve them throughout the

expected life of the facility. The method of storage should allow for the logs to be readily retrieved if they are needed for reference. DOE-G-1324.5B, *Guide for Records Management*, contains additional guidelines for document control and disposition.

4.8 Computerized Logs

The handling and security of electronic data must be taken into consideration before initiating computerized logs. Facility procedures should discuss, in detail, the controls applicable to manual logging and computerized logkeeping. Provisions for revisions by supervisory staff (though retaining the original entry) should be feasible.

SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE-G-1324.5B, *Guide for Records Program.*

DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XII, "Operations Turnover."

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APPENDIX A
EXAMPLE LOG ENTRIES

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EXAMPLE LOG ENTRIES

1			41
2	05/15/92	1415	Maintenance reported completion of work on Building 202 fire main.
		1428	Cleared tagout TO-92-098 for Building 202 fire main and began
			post-maintenance testing; Senior Mechanic William Jones monitored
			testing for maintenance.
		1445	Building 202 fire main post-maintenance testing completed
			satisfactorily; fire main placed in service; fire watch cancelled.
		1530	Inspected Building 202 fire main; no problems noted.
3		1559	Relieved by John A. Smith. *Tim Anderson*
4	05/15/92	1559	Assumed shift. *John A. Smith*
	1600-2400		Plant status as above.
	C Shift	1635	Rotated process supply water pumps. Status: Pump 1 - Standby,
			Pump 2 - On-line, Pump 3 - Standby.
		1655	Noticed potential safety problem outside south entrance to Building
			205. Runoff has eroded ground beside walk. Roped off area and
			informed Shift Supervisor. Completed work request WR-1038-92 to
			have hole filled.
6		1715	Relieved by Janet Black. *John A. Smith*
		1715	Assumed the shift. *Janet Black*
		1805	Process Control operator requested 500 gallons of de-ionized (DI) water.
			Notified Shift Supervisor and aligned DI Unit 2 to supply water to
			process.
		1850	Relieved by John A Smith. *Janet Black*
		1850	Assumed shift. *John A Smith*
		1910	Process Control operator reported delivery of 500 gallons DI water
7			completed. Informed Shift Supervisor. DI ~~Unit 3~~ JAS 05/15/92 Unit 2 is
			due for regeneration during midnight shift.
		2125	Informed by Shift Supervisor of National Weather Service severe
			thunderstorm watch in effect until 2230.
		2130	Checked that all doors and windows are secured in Building 202 and 204

(Numbers in left margin refer to notes on page A-5.)

	42		
8	05/15/92	2220	Packing leakage on process supply water Pump 2 is out-of-specification
			per round sheet. Leakage rate is approximately 3-5 gallons per minute
			(gpm), specification is 1 gpm. Cause appears to be packing failure.
			Notified Shift Supervisor and placed Pump 3 on-line. Took Pump 2 out
			of service and placed caution tag C-087-92. Pump 2 status is now
			Emergency Use Only.
9		2252	Reviewed log. *James Campbell*, Shift Supervisor.
10	Incorrect	2254	Maintenance reported work completed on process cooling water Pump 3.
	data, See	2315	Cleared caution tag C-087-92 and installed tagout TO-92-105 for process
	05/16/92,		supply water Pump 2.
11	0045. *TD*.	2345	LATE ENTRY: 2225 Wrote Work Request WR-1039-92 for process
			supply water Pump 2 and delivered to Shift Supervisor.
	05/16/92	0003	Relieved by Tony Diaz. *John A. Smith*
12	05/16/92	0003	Assumed shift. *Tony Diaz*
	0000-0800		Process Facility status: Normal operation; Water plant status: Operational
	B Shift		Process cooling water (PCW) system: Pump 1 - Tagged out
			Pump 2 - On line Pump 3 - Tagged out
			Process supply water (PSW) system; Pump 1 - Standby
			Pump 2 - Tagged out Pump 3 - On line
			Incomplete tasks: 05/15/92, 1910 - Regenerate DI Unit 2
13		0045	Incorrect entry identified. Entry of 05/15/92, 2254, states that
			Maintenance reported completion of work on PCW Pump 3. Work is still
			in progress on PCW Pump 3. Entry should read: "work completed on PCW
			Pump 1," as confirmed by Shift Supervisor.
		0120	Started regeneration of Deionizer Unit 2.
		0240	Maintenance reported completion of packing gland adjustment on PSW
			Pump 2. Verified that packing leakage is now 1 gpm.
		0255	Cleared tagout TO-92-105. Psw Pump 2 status is now Standby.

NOTES

1. No entries are made in unruled margin at the top of the page, nor in the partial line at the bottom of the page.

2. The date is entered at top of each page. Each entry is preceded by the time, using a 24-hour clock system.

3. The final entry at the completion of a shift identifies the relief and contains the signature of the person keeping the log.

4. The initial entry at the beginning of a shift contains the signature of the person keeping the log. The date, shift hours, and shift designation have been included in the margin.

5. The entry for a subjective observation or problem discovered by the operator identifies what the operator found, the actions taken, and the notifications made.

6. The entries for a relief during the shift meet the same requirements as entries at a scheduled shift turnover.

7. The person keeping the log made an error and corrected it by lining through the incorrect entry, writing the correct information, and initialing and dating the change.

8. A log entry provides additional information related to an out-of-specification reading or indication. The entry includes a description of the out-of-specification condition, the probable cause, notification(s) made by the operator, and the action(s) taken.

9. The supervisor reviewed the log and documented his review.

10. A margin notation draws attention to an error discovered by someone other than the individual who made the log entry. See Note 13.

11. A late entry, recorded out of proper time sequence, indicates the actual time of the occurrence.

12. This initial entry includes a status update and a listing of incomplete tasks carried forward from previous shift(s).

13. The person keeping the log found an error in an earlier entry made by another person. A new entry in the log identifies the incorrect information and corrects it. A notation was also made at the location of the incorrect entry.

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DOE-STD-1035-93

CONCLUDING MATERIAL

Review Activities:

DOE
DP
EH
EM
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NS

Preparing Activity:

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DOE STANDARD

GUIDE TO GOOD PRACTICES FOR INDEPENDENT VERIFICATION

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

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Guide to Good Practices for Independent Verification

Page / Section	Change
p. 11 / Section 4.1.2	The reference to DOE-STD-1030-92, *Guide to Good Practices for Lockouts and Tagouts,* was updated to DOE-STD-1030-96 with the same title.
p. 14 / Section 4.2.1	The reference to DOE-STD-1030-92, *Guide to Good Practices for Lockouts and Tagouts,* was updated to DOE-STD-1030-96 with the same title.
p. 16 / Section 4.2.2	The reference to DOE Order 4330.4A, *Maintenance Management Program,* was updated to DOE Order 4330.4B with the same title.
p. 24 / Section 4.3.7	The reference to DOE-STD-1030-92, *Guide to Good Practices for Lockouts and Tagouts,* was updated to DOE-STD-1030-96 with the same title.
p. 27 / Supplemental Resources	The reference to DOE Order 4330.4A, *Maintenance Management Program,* was updated to DOE Order 4330.4B with the same title. The reference to DOE-STD-1030-92, *Guide to Good Practices for Lockouts and Tagouts,* was updated to DOE-STD-1030-96 with the same title.
Concluding Material	The Preparing Activity was updated from NE-73 to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, "Conduct of Operations Requirements for DOE Facilities."

KEYWORDS

Concurrent Dual Verification

Lockout/Tagout

Operations Supervisor

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ACRONYMS

EPA	Environmental Protection Agency
ES&H	Environmental, Safety, and Health
OSHA	Occupational Safety and Health Administration

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DEFINITIONS

Concurrent Dual Verification	A method of checking an operation, an act of positioning, or a calculation, in which the verifier independently observes and/or confirms the operation or calculation.
Danger Tags	Tags used to identify equipment or controls that MUST NOT be operated or removed.
Independent Verification	The act of checking, by a separate qualified person, that a given operation, or the position of a component, conforms to established criteria.
Lockout/Tagout	A general term for all methods of ensuring the protection of personnel and equipment by installing tagout devices, with or without lockout devices.
Operations Supervisor	The individual having authority and responsibility for operational control of a facility, process, experiment, or other project.

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GUIDE TO GOOD PRACTICES FOR INDEPENDENT VERIFICATION

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Independent Verification, Chapter X of Department of Energy (DOE) Order 5480.19, "Conduct of Operations Requirements for DOE Facilities." The practices in this guide should be considered when planning or reviewing independent verification activities. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Independent Verification" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for coordinated independent verification activities to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

Independent verification activities are implemented by appropriate policies and procedures to ensure correct operation of facility equipment, and aid in the control of equipment and system status.

Criteria:

a. Components critical to safe, reliable operation of the facility are identified as to their requirements for independent verification.

b. Occasions requiring independent verification are identified through appropriate policies and procedures.

c. Independent verification techniques are identified consistent with facility equipment and operational requirements.

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3. DISCUSSION

Independent verification compensates for the human element in facility operation. It recognizes that any operator, no matter how proficient, can make a mistake. However, the chance that two operators will independently make the same mistake is unlikely. Therefore, independent verification provides an extra measure of safety and reliability to facility operations. Industry experience shows that verifying, or double-checking, important operating parameters and component alignments reduces the occurrence of unintended operational events (shutdowns, environmental violations, etc.).

Independent verification is an activity designed to enhance the reliability of facility operations and safety functions, and to aid in the control of equipment and system status. Its intent is similar to the quality assurance and engineering checks that are performed during design and installation of facility systems. However, independent verification is an ongoing process performed by operations personnel during operations. Independent verification activities are built on the two concepts portrayed through their name: verification and independence.

Verification is the act of checking that an operation, the status of equipment, a calculation, or the position of a component conforms to established criteria. Verification only checks for conformance with the criteria; it does not alter the status of equipment or the position of components. The criteria used for verification are normally contained in operating procedures or alignment checklists. All persons performing verification must receive specific training and qualification on the systems they will verify, and on techniques for verifying component position or status.

Independence means that the person performing the verification will not be influenced by observation of, or involvement in, the activity that establishes the component position or status. For most operating activities, independence can best be achieved by separating the operation and the verification by time and distance. For example:

> If a verifier watches an operator read from a procedure, check the component label, operate the component, and then mark the item off in the procedure, it would be natural for the verifier to assume that the operation was performed correctly. However, the operator could have misread the procedure, misread the label, incorrectly identified the equipment, or performed the wrong operation. If the verifier is not present during the operation (separated by distance) and performs the verification at a later time, then the verification will not be affected by the operator's actions. If the verifier walks through the procedure, personally checking the label information and verifying the position of the components, any mistake made by the operator is likely to be detected.

For some operating activities, separating the operation and the verification by time and distance may not be possible. For example, verifying the position of a throttle valve or other control may require observation of the positioning activity. Verification for the installation or removal of jumpers may require checking the intended action before it is performed, because incorrect performance could cause a shutdown of critical equipment or actuation of a safety system. For these types of operating activities, the operator and verifier should independently identify the component and then concur on the action to be performed. The verifier should observe that the operation is performed correctly. This method is termed "concurrent dual verification."

Independent verification will be most effective if it is incorporated into existing operating activities. Each facility's operating guidelines should identify the specific systems, structures, and components that require independent verification. Within those systems, structures, and components, the guidelines should identify the occasions when independent verification should be performed. Facility procedures should provide instructions for the independent verification techniques appropriate to specific systems and components. These instructions are necessary to ensure that verification is performed consistently, and that verification activities do not change the component status or upset the process. Independent verification requirements should be addressed in pre-job briefings, to identify the personnel involved and to clarify the methods that will be used. Facility training programs should include subjects

related to independent verification, such as development of a questioning attitude, self-checking techniques, and methods to avoid undue influences while acting as the performer or verifier.

Separate from the requirement for independent verification of specific operations activities, the concepts of independent verification can be applied to other functions or activities that can affect operations. For example, independent appraisals of operating procedures and training should be performed to verify that environmental, safety, and health considerations have been addressed in accordance with operational requirements. Personnel should apply the principles of independent verification to all operating systems in their work areas, not just those having safety functions. System parameters should be checked against each other and against expectations. When problems are identified, individuals should notify supervision and initiate corrective action in accordance with applicable procedures. This process helps ensure that problems are identified early and corrected before they cause larger problems.

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4. GOOD PRACTICES

Each facility should provide written guidelines for implementing independent verification. Central to these guidelines are two related, but independent, criteria for independent verification. First, independent verification is clearly important for certain systems and components, but is not necessary for all facility equipment. Therefore, the facility guidelines should identify the systems, structures, and components requiring independent verification. Section 4.1 provides guidance for designating which of these should receive independent verification.

Second, for those systems, structures, or components that have been designated as requiring independent verification, there are many routine operating activities performed that require independent verification. Section 4.2 provides guidance to help determine what situations involving the designated systems, structures, and components should be identified as occasions for independent verification.

The methods or techniques used to perform independent verification must be capable of verifying compliance with the operational criteria, without changing the position or status of the equipment. Therefore, the facility's guidelines should also specify how independent verifications should be performed. Examples of techniques that may be applied for independent verification are given in Section 4.3.

4.1 Systems/Components Requiring Independent Verification

Independent verification should be performed on systems, structures, and components that impact the safety and reliability of facility operations. Facilities should identify components requiring independent verification on the basis of safety analysis and evaluation of the effects that may be caused by mispositioning. Independent verification should be performed on systems, structures, and components that perform functions in the following categories:

- Related to nuclear safety (for reactors and non-reactor nuclear facilities)

- Essential for preserving environmental, safety, or health controls

- Critical to performance of the facility's designated mission.

4.1.1 Nuclear Safety Functions

Independent verification should be considered for all systems, structures, and components performing nuclear safety functions. Facilities that handle or process radioactive materials must determine which facility components require independent verification, based on the reliance placed on the component for preventing or mitigating releases of, or exposures to, radioactive materials. The following are examples of components and systems that may have a nuclear safety function:

- Components that monitor radiation or radioactive materials (e.g., area radiation monitor, criticality alert monitor, airborne activity monitor)

- Components that prevent unintentional release of radioactive materials (e.g., hold-up tanks, vent valves, drain valves)

- Components that are essential for proper response to an emergency (e.g., deluge systems, automatic barriers, safety injection systems).

4.1.2 Environmental, Safety, and Health (ES&H) Functions

All facilities (not just nuclear facilities) contain systems, structures, and components that perform safety functions and/or prevent unintentional releases of hazardous or toxic materials into the environment. Systems, structures, and components performing these functions should be

considered for independent verification. The following are examples of components and systems that may have an ES&H function:

- Fire protection systems (e.g., fire detection systems, fire-fighting water supply and storage, halon and carbon dioxide (CO_2) storage systems)

- Ventilation systems (e.g., toxic fume hoods, glove boxes, breathing air supplies)

- Emergency power systems (e.g., uninterruptible power supplies (UPS), emergency generators, load shedding or transfer switches)

- Components preventing uncontrolled release of toxic or radioactive materials into the environment (e.g., isolation valves, monitoring systems, hold-up tanks).

In addition to components of designated safety or environmental protection systems, certain components in virtually any system may perform a safety function when used as part of a lockout/tagout. Such components include circuit breakers and valves used to isolate energy or hazardous materials from a work area, grounds installed prior to service on electrical equipment, telltale bleed lines for verifying hazardous material isolations, etc. The facility's lockout/tagout program should address the use of these components in protecting personnel and equipment, and the verification required in connection with that use. A more complete discussion of the requirements for personnel protection during service or maintenance is found in DOE Order 5480.19, Chapter IX, "Lockouts and Tagouts," and in DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts*.

4.1.3 Mission-Critical Functions

Independent verification is more than just an adjunct to the facility safety or environmental control programs; it is a tool that can be used to enhance the reliability of facility operations. Applying independent verification to production-related systems and components helps reduce unscheduled shutdowns and other unplanned reductions in the facility output. Systems, structures, and components that are critical to the performance of the facility's mission should be considered for independent verification.

In addition to the systems, structures, and components that fill nuclear safety, ES&H, and mission critical functions, independent verification should also be considered for systems or components that could challenge a safety system or mission critical system. For example, testing or changing the alignment of certain components in a non-safety, non-critical system may cause spurious actuation of a safety system or a transient upset in a mission-critical system.

4.1.4 Components Excluded from Independent Verification Requirements

In some systems where independent verification is required, specific components may be excluded from the requirement if certain conditions are met. Independent verification may not be required for a particular component if:

- Mispositioning the component would not affect system performance (i.e., the system could perform its intended function even if the particular component were mispositioned). For example, a cooling system may be able to perform its intended function even though an air vent or water drain valve in a heat exchanger is not properly

positioned. In this case, the vent or drain valve may not require independent verification.

- Mispositioning the component would be known immediately to an operator (i.e., a reliable indicator of component position or an alarm would alert an operator if the component position is not correct). The presence of position indicating lights for a valve is not considered sufficient justification for excluding the valve from independent verification requirements. However, the lights may be used along with other process parameters to verify the valve position.

- Significant exposure to radiation or hazardous material would be received by the person(s) performing the independent verification. In this case, an alternative method for verification should be found, such as observing process parameters or reliable remote indication.

Any components exempted from independent verification requirements through the criteria listed above should be approved by the operations supervisor.

4.2 Situations Requiring Independent Verification

Independent verification should be performed whenever there is a reasonable chance that the proper function of any system, structure, or component identified in Section 4.1 is jeopardized. For example: whenever components of a system are manipulated, there is a chance that the resulting alignment is not correct; or, when operations are performed on similar, nearby systems, there is a chance of inadvertently manipulating a component in the wrong system. Independent verification of these activities would prevent further undesirable consequences.

This is not meant to imply that every operation in the facility should be independently verified. The consequences of alignment errors in certain equipment systems (those not meeting the criteria of Section 4.1) may not justify the expenditure of resources and effort involved in independent verification. Facilities should evaluate their operations to determine when independent verification should be performed, then document the determinations in appropriate guidelines or procedures. The following subsections discuss four specific situations when independent verification should be performed on the systems, structures, and components designated in Section 4.1.

4.2.1 Removing Equipment from Service

When nuclear safety, ES&H, or mission critical equipment is removed from service, the critical or safety functions the equipment had performed must often be transferred to other equipment or systems remaining in service. Independent verification should be performed to ensure that the critical or safety function is not inadvertently disabled. For example, consider a safety system containing two redundant pumps that discharge into a common header. One of the pumps must be removed from service for maintenance in accordance with lockout/tagout procedures.

- Independent verification should be performed to ensure that the remaining pump is properly aligned for service and has not been inadvertently isolated.

- Independent verification should always be performed after installation of a lockout/tagout to ensure that adequate protection for workers is provided, as described in DOE Order 5480.19, Chapter IX, "Lockouts and Tagouts," and in DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts*.

4.2.2 Placing Equipment in Service

Whenever nuclear safety, ES&H, or mission critical equipment is placed in service, or returned to service following maintenance, testing, or an extended shutdown, independent verification should be performed. Listed below are some of the reasons for performing independent verification when placing equipment in service.

- When equipment has been out of service for maintenance, the position of components within the lockout/tagout boundary could have been changed during maintenance.

- Components that have been involved in a test may have been left in the test position and not reconfigured for operation.

- During extended shutdowns, it is often impractical to maintain equipment in its normal operating configuration.

- Startup activities may involve overlapping procedures for the lineup or testing of multiple interfacing systems, possibly resulting in uncertainty as to whether the final position of components is correct.

Independent verification at the time equipment is returned to service is not the same as, nor intended to take the place of, post-maintenance testing. Post-maintenance testing is normally required for all facility equipment, whereas independent verification normally is not required on non-critical, non-safety equipment. In some limited situations, post-maintenance testing of critical or safety systems may satisfy a requirement for independent verification. However, the programs and criteria remain separate. Further information regarding post-maintenance testing is contained in DOE Order 5480.19, Chapter VIII, "Control of

Equipment and System Status," and DOE Order 4330.4B, *Maintenance Management Program*.

4.2.3 Periodic Checks during Facility Operation

Many facilities are required, by technical safety requirements or by regulatory agencies (e.g., OSHA, EPA, state agencies), to perform routine periodic checks of the operability of certain systems, structures, and components. Routine periodic checks include:

- Testing fire protection systems to ensure that they are properly aligned for operation

- Testing Continuous Emission Monitors to ensure that they detect and record regulated emissions

- Testing toxic gas monitoring equipment (e.g., in oil well drilling and production facilities) to ensure that the equipment will detect a specific concentration of toxic gas and actuate an alarm.

These periodic checks (defined as surveillance tests in some facilities) are independent of the activities that established the status of the system, and therefore qualify as independent verifications.

When there are no regulatory requirements for periodic verification or surveillance, it is still a good practice to periodically check the alignment and status of safety and mission-critical equipment. Verification may be performed using normal operating procedures, or specific checklists may be developed for the purpose. Components to be checked may be included on operator round sheets.

If the position or status of a component is changed during performance of one of these checks, the check does not qualify as an independent verification. If the affected component was designated in accordance with Section 4.1, then a separate independent verification of the positioning change should be performed.

4.2.4 Temporary Modifications

Installing or removing temporary modifications (e.g., jumpers, bypasses, or other temporary connections) should be independently verified when an error could cause the shutdown of critical equipment, actuation or disabling of a safety system, or uncontrolled start of equipment that could endanger personnel. In these situations, verification should be performed before and during performance of the activity using concurrent dual verification.

4.3 Verification Techniques

It is not the intent of this guide to describe appropriate techniques for independent verification of all the components and processes used throughout DOE facilities. Each facility should develop instructions for independent verification, using input from experienced facility personnel and equipment manufacturer's recommendations. The instructions should describe techniques for independent verification of manual valves, motor-operated and air-operated valves, solenoid-operated valves, blank flanges, circuit breakers, removable links, fuses, availability of control power, accuracy of calculations, etc. Techniques may involve direct verification (e.g., physically checking that a valve is closed) or indirect verification (e.g., observing system parameters to determine that a valve is closed).

The instructions should focus the verifier's attention on the aspects of the operation that are most susceptible to errors and/or are most critical for proper

function of the system. Some operations can be verified by checking the final condition or position of components against a standard, i.e., a product-based approach. For example:

- During a lockout/tagout, it is critical that the tags be placed on the correct components. To ensure that no identification errors were made, the instructions should require the verifier to independently identify each component using the same procedures, drawings, checklists, and component label information that were used by the performer; then verify that the component is correctly tagged.

- When isolating a component or aligning a system for operation, each valve, switch, bypass, or other device must be correctly positioned according to an operating procedure or other documentation. The verifier should be instructed to independently check the physical position of these components, or perform other checks that will positively indicate that the components are properly positioned.

In some operations, it is critical that the performer follow a specific process or series of sequential steps. It may be impossible for the verifier to determine that the steps were performed correctly through observation of the finished product. These operations should be verified by independently observing that the proper steps, sequence, or adjustments are performed according to a standard. The method for this is known as concurrent dual verification. For example:

When installing a bolted cover on a piece of equipment, the bolts must be tightened to a specific torque value in a specific sequence to prevent damaging the cover. Instructions for verifying this operation should have the verifier independently observe that the correct torque is applied and that the bolts are tightened in the required sequence.

In all cases, the instructions should minimize the interaction between the performer and the verifier to preserve the independence of each.

Once the instructions are developed, personnel involved in performing independent verification should be trained on the techniques. Operating experience alone may not provide adequate knowledge for performing independent verification. Specific training on the techniques for independent verification enhances their reliability. The training may be performed as part of the operator qualification program and/or the facility continuing training program.

The general guidelines that follow should be considered when developing specific verification techniques. When possible, verification should be performed using more than one indication or technique, e.g., performing a physical verification and checking system parameters.

4.3.1 Verifying Valve Position

It is not always possible to determine if a valve has been completely closed or opened by merely observing the action. The relative height of a valve stem is not considered a reliable position indicator for independent verification. Lines scribed on the valve stem or other positive indicators of stem position can aid in accurately determining the valve position. However, a mechanical indicator may not accurately reflect the position after maintenance has been performed on the valve, or even after a period of normal use.

The preferred method for verifying valve position is a physical verification. A visual check of the stem position or position indicators should be used whenever possible to confirm the physical verification. Physical verification of a manually operated valve should be performed

by attempting to turn the valve in the closed direction. The effects of this are:

- If the valve is closed, attempting to turn the valve in the closed direction will not effect its position. Closed valves should NOT be opened for verification to prevent adversely affecting system integrity, because even a slight opening can pressurize or release hazardous materials into the downstream piping.

- If the valve is open, the verifier will be able to turn the valve in the closed direction. Only a slight movement in this direction is needed to confirm that the valve is open, without affecting the flow or process. The verifier should then restore the valve to its original position.

If the valve position is not in accordance with the requirements, the verifier should NOT operate the valve further, and should notify the cognizant supervisor.

4.3.2 Verifying Throttled Valves

Some valves are required to be in a throttled position, i.e., intermediate between fully open and fully closed. Often the procedure for establishing the throttled position is to close the valve, then count a specific number of turns in the open direction. If this same action were to be performed by a verifier, the original positioning would be nullified, constituting no verification.

If possible, alternate means should be established for verifying throttled valves. If the position of the valve stem would provide visible indication of the valve position, the facility may place a label or scribe marks on the

valve stem to use in independent verification. Other types of valve position indicators may be approved by the facility. In these cases, the throttled valve position may be independently verified by visually checking the valve and the position indicator.

If it is necessary to close and reopen the valve to establish its position, it is preferable to have both the performer and the verifier present (concurrent dual verification). The verifier should independently verify that the correct valve was identified, its required position was correctly determined according to the procedure, the positioning was performed correctly, and process parameters, if available, confirm the correct positioning.

4.3.3 Checking Process Parameters

Observation of process parameters (e.g., pressure, flow, voltage) may help verify the correct position of components. However, process parameters alone may not give an accurate indication of component status, because alternate flow paths or other factors may cause misleading indications. For example,

- Voltage on a circuit does not prove that a particular supply breaker is closed unless there is no alternate power supply

- Flow and pressure do not necessarily prove that a valve is fully open.

Observation of process parameters should be combined with other verification methods, such as physical checks of component position, whenever possible. Facility guidelines should specify where and when process parameters alone are acceptable indicators of component position.

4.3.4 Checking Remote Position Indicators

Independent verification should always be performed locally, unless precluded by exposure to radiation, hazards, or other overriding factors. In those limited situations, independent verification may be performed using remote position indicators. The most common of these are indicating lights.

Remote position indicators may seem to represent an ideal method for independent verification. However, equipment failures in the sensor, signal transmission, or display device can cause valve-position-indicating lights and other control board indications to be incorrect. Some failures of this type have gone undetected for a significant length of time. Independent verification using remote position indicators should be checked using other verification methods, such as process parameters, whenever possible.

4.3.5 Surveillance (Operational) Testing

Certain systems and components are subject to periodic surveillance (operational) tests due to regulatory requirements. In many cases, the nature of the test qualifies it as an independent verification of system alignment and capability. For example, a full-flow test of a system can prove that the alignment of components and positioning of flow-controlling valves is correct. This means of proving operability is not the same as the means used to establish the position of the components, and therefore is independent of the original activity.

Some surveillance tests may not test the components in their operating configuration, or they may not include all the components that would be required for operation. For example, running a pump in recirculation to

verify discharge pressure would not prove that the main flow-path valves were correctly positioned, and may not prove that external cooling or backup lubrication pumps are properly aligned.

Surveillance testing may be used to satisfy independent verification requirements ONLY if it is shown conclusively that the test proves the required position of the components in question. Because surveillance testing involves operation of equipment, the operations supervisor should approve any performance of surveillance tests.

4.3.6 Verifying Operational Processes

Sometimes verification is required for an operational process or proper completion of a series of procedural steps. Concurrent dual verification is one method for accomplishing this. The following is an example of independent verification of an operational process, in this case performing a calculation:

> A calculation of the estimated critical position (ECP) for reactor control rods is required before a reactor startup. In at least two recent incidents, errors in this calculation went undetected until the reactor startup was in progress. When the discrepancy was discovered, the reactors in question were shut down in accordance with procedures, and further investigation revealed errors in the calculations. As a result of these incidents, DOE has directed all reactor facilities to perform two independent ECP calculations when required for reactor startup. If a computer code is used to calculate the ECP, two independent determinations of input parameters are required. The responsible manager must reconcile any differences in the calculations prior to startup.

4.3.7 Verifying Locked/Tagged Components

Components that are danger tagged in accordance with the facility's lockout/tagout procedure must NOT be manipulated in the performance of an operating procedure or for the purpose of independent verification. If such components are encountered during independent verification, the verifier SHOULD NOT attempt to physically verify the position. The verifier SHOULD verify that the correct component has been identified, determine the required position in accordance with the procedure, determine the position of the component as recorded on the danger tag, and use all other appropriate methods to verify that the component is positioned as stated on the danger tag (e.g., observe process parameters, remote indicators, etc.). Additional information relating to locked/tagged equipment is contained in DOE Order 5480.19, Chapter IX, "Lockouts and Tagouts," and in DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts*.

4.3.8 Resolving Inconsistencies Discovered during Independent Verification

The underlying principle of independent verification is that anyone can make a mistake. This also means that any inconsistency identified by the verifier could be the verifier's mistake. The verifier should NOT change the position or status of a component to correct an inconsistency. Whenever an inconsistency is discovered, the verifier should immediately stop and notify the appropriate supervisor. Facility procedures should identify the supervisory position responsible for resolving independent verification inconsistencies.

When informed of the inconsistency, the supervisor should resolve the issue (e.g., by physically verifying the position of the component in

question). If repositioning is required, it should be approved by the supervisor. If the component is subject to administrative controls (e.g., lockout/tagout), the supervisor must ensure compliance with those guidelines during physical verification or repositioning.

4.4 Operations Self-Appraisal and Verification

Independent verification is a formal process for ensuring safety and reliability in facility systems. However, the concepts of verification and independence have a wider application. Programs and activities that affect operations should receive independent appraisals or verifications to ensure that they meet established criteria relating to safety, health, environmental protection, and operational practices. For example, procedure development and training are activities that have a direct impact on operations. These activities should be evaluated through self-appraisal and independent (e.g., operations organization) review to ensure that they accomplish their intended purpose and are consistent with applicable regulatory and operational guidelines.

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SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices.

DOE Order 4330.4B, *Maintenance Management Program*.

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter VIII, "Control of Equipment and System Status."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter IX, "Lockouts and Tagouts."

DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts*.

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CONCLUDING MATERIAL

Review Activities:

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DP

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EM

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NE

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Preparing Activity:

DOE-EH-31

Project Number:

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DOE STANDARD

GUIDE TO GOOD PRACTICES FOR OPERATIONS ASPECTS OF UNIQUE PROCESSES

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

AREA MISC

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Guide to Good Practices for Operations Aspects of Unique Processes

Page / Section	Change
p. vii / Definitions	The definition for "Performance-Based Training" was deleted, and the definition for "Systematic Approach to Training" was added.
p. 10 / Section 4.2 / fourth paragraph	The references to the performance-based training (PBT) approach were changed to the systematic approach to training (SAT).
p. A-3 / Operator Knowledge Resource List / first sentence	The reference to the performance-based training (PBT) approach was changed to the systematic approach to training (SAT).
p. A-3 / Operator Knowledge Resource List	The reference to DOE-NE-STD-1001-91, *Guide to Good Practices for Training and Qualification of Instructors,* was updated to DOE-HDBK-1001-96 with the same title.
p. A-3 / Operator Knowledge Resource List	The reference to DOE-NE-STD-1002-91, *Guide to Good Practices for Training and Qualification of Chemical Operators,* was updated to DOE-HDBK-1002-96 with the same title.
p. A-3 / Operator Knowledge Resource List	The reference to DOE-NE-STD-1003-91, *Guide to Good Practices for Training and Qualification of Maintenance Personnel,* was updated to DOE-HDBK-1003-96 with the same title.
p. A-3 / Operator Knowledge Resource List	The reference to DOE/NE-0102T, *TAP 2 Performance-Based Training Manual,* was updated to DOE-HDBK-1078-94, *Training Program Handbook: A Systematic Approach to Training.*
p. A-3 / Operator Knowledge Resource List	The reference to DOE-STD-1005-92, *Guide to Good Practices for Developing Learning Objectives,* was updated to DOE-HDBK-1200-97 with the same title.
p. A-3 / Operator Knowledge Resource List	The reference to DOE-STD-1006-92, *Guide to Good Practices: Evaluation Instrument Examples,* was updated to DOE-HDBK-1201-97 with the same title.
p. A-3 / Operator Knowledge Resource List	The reference to DOE-STD-1007-92, *Guide to Good Practices for Teamwork Training and Diagnostic Skills Development,* was updated to DOE-HDBK-1202-97 with the same title.

p. A-3 / Operator Knowledge Resource List	The reference to DOE-STD-1008-92, *Guide to Good Practices for Training of Technical Staff and Managers,* was updated to DOE-HDBK-1203-97 with the same title.
p. A-3 / Operator Knowledge Resource List	The reference to DOE-STD-1009-92, *Guide to Good Practices for the Development of Test Items,* was updated to DOE-HDBK-1204-97 with the same title.
p. A-3 / Operator Knowledge Resource List	The reference to DOE-STD-1010-92, *Guide to Good Practices for Incorporating Operating Experience,* was removed (document was canceled).
p. A-3 / Operator Knowledge Resource List	The reference to DOE-STD-1011-92, *Guide to Good Practices for the Design, Development, and Implementation of Examinations,* was updated to DOE-HDBK-1205-97 with the same title.
p. A-3 / Operator Knowledge Resource List	The reference to DOE-STD-1012-92, *Guide to Good Practices for On-the-Job Training,* was updated to DOE-HDBK-1206-98 with the same title.
p. A-3 / Operator Knowledge Resource List	The reference to DOE-STD-1058-93, *Guide to Good Practices for Developing and Conducting Case Studies,* was updated to DOE-HDBK-1116-98 with the same title.
p. A-4 / Operator Knowledge Resource List	The reference to DOE-STD-7501-95, *Development of DOE Lessons Learned Programs,* was added.
Concluding Material	The Preparing Activity was changed from NE-73 to EH-31.

FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*.

KEYWORDS

Integrated Knowledge
Process Support Personnel
Unique Process

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   - OPERATOR KNOWLEDGE RESOURCE LIST A-1

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DEFINITIONS

Integrated Knowledge	An understanding of the interrelated functions of facility equipment and systems.
Operator	A qualified person assigned specific responsibilities related to the operation of facility process systems and equipment.
Systematic Approach to Training (SAT)	A training program that includes the following five elements: (1) Systematic analysis of the jobs to be performed; (2) Learning objectives derived from the analysis which describes performance after training; (3) Training design, development, and implementation based on the learning objectives; (4) Evaluation of trainee mastery of the objectives during training; and (5) Evaluation and revision of the training based on the performance of trained personnel in the job setting.
Process Support Personnel (Technical Process Support Personnel)	Personnel responsible for controlling unique processes.
Unique Process	A separate facility process that can affect, or be affected by, an operator's activities, but is controlled by process support personnel.

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GUIDE TO GOOD PRACTICES FOR OPERATIONS ASPECTS OF UNIQUE PROCESSES

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Operations Aspects of Facility Chemistry and Unique Processes, Chapter XIII of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The practices in this guide should be considered when planning or reviewing employee training and facility management programs. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Operations Aspects of Unique Processes" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for all personnel to coordinate interrelated activities affecting unique processes.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

A system is in place to ensure that the operation of interrelated processes is properly monitored and controlled.

Criteria:

a. Personnel responsibilities are defined with respect to unique processes.

b. Personnel are knowledgeable of unique processes and process interactions.

c. Personnel are able to interpret parameters and provide timely corrective action for process-related problems.

d. Lines of communication exist between operators and process support personnel to promote effective coordination of activities.

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3. DISCUSSION

A unique process is a separate process that is not directly controlled by operations personnel, but can affect, or be affected by, an operator's activities. It could be directly related to the safety or reliability of the facility, compliance with environmental and health requirements, fulfillment of the facility mission, or unrelated to any of these. A unique process may be the result of a specialized procedure (e.g., testing or research) and performed only once, or it may be an established routine. The operations aspects of unique processes can be described as the effects unique processes or activities may have on interrelated systems, and the actions that must be taken to avoid an adverse impact on operations.

Interactions between operations and unique processes can affect the safety and reliability of DOE facilities. In some cases, interactions with unique processes are anticipated in procedures and other operating documents. However, in many cases, an otherwise appropriate and permissible response to parameters in one system can produce an adverse effect in another system. To correctly interpret indications in a system, and to determine the best response, the operator must have an integrated knowledge of unique process interactions within the facility.

Effective operation also requires communication of relevant information between operators and process support personnel. In some cases, the operator must communicate intended actions to the process support personnel to prevent problems in the unique process. In other cases, the unique process is capable of affecting operations, therefore requiring two-way communication between process support personnel and operators. The following examples illustrate some of the effects of unique process interactions.

- A facility operates a chilled water system to support a variety of domestic and research needs. The system contains multiple chiller units which can be operated in combination to accommodate cooling loads. When personnel in a research project started several large pieces of equipment, the added cooling load caused the chilled water temperature to exceed the normal operating range before another chiller unit could be placed on line.

This example illustrates how a unique process can affect an operator's activities. The research was a unique process to the chilled water system operator. Although the operator did not require detailed knowledge of the research, integrated knowledge of the system interactions was needed. Effective communication with the research project personnel would have enabled the operator to anticipate the load increase and ensure that sufficient reserve cooling capacity was on line.

- A periodic chemistry sample from a fluid system is used to evaluate the condition of the system components and determine their fitness for continued operation. Just before the sample was taken, the system operator started a pump that had been in a standby status. The change in flow characteristics caused contamination to be picked up in the sample. The indicated level of contamination normally signals equipment damage, which requires resampling the system and possible shutdown of equipment.

  This example illustrates how a unique process can be affected by an operator's activity. To the operator, chemistry sampling is a unique process, even though it is routinely performed. To prevent adverse effects on the sample, the operator requires an integrated knowledge of the process interactions, i.e., how the sampling is affected by pump startup, and needs to inform chemistry support personnel of operating activities that can adversely affect sampling. This would permit coordination of operations and chemistry activities, and would have avoided the need for resampling.

- Technicians working with radioactive materials needed to move the materials through an operational area of the facility. Following their procedures, they took all appropriate precautions to prevent the spread of contamination or personnel exposure during the movement; however, they failed to coordinate their movement with the operations supervisor. The materials set off an operational radiation alarm, causing the operations organization to respond as if an emergency had occurred.

  The movement of radioactive material may have had nothing to do with the facility operation or mission. However, the movement was capable of affecting operations and was

not under the control of operations personnel; therefore, it constituted a unique process. If the process support personnel (technicians) had coordinated their activities with the operations supervisor, the operations personnel would have prepared for the alarm and avoided the emergency response.

Note that in each of these events, the persons involved were properly trained and qualified to perform their own job responsibilities. What they lacked was knowledge of the effects their activities would have on other processes. An integrated knowledge of the interfacing unique processes, and effective communication based on that knowledge, could have prevented each problem. Integrated knowledge may include:

- Fundamentals of the applicable physical sciences (i.e., chemistry, electricity, physics, thermodynamics, etc.) involved in interfacing unique processes

- Purpose and fundamentals of system design for interfacing unique processes

- Normal, and anticipated abnormal, operating characteristics of interfacing unique processes.

Facilities should ensure that personnel at all levels have sufficient knowledge of interfacing or unique processes to ensure safety and efficiency in the working environment. Training, job experience, and direct communication with process support personnel are all methods to provide this integrated knowledge to operators. Facilities should encourage personnel to be technically inquisitive, to detect, understand, and anticipate problems while monitoring process parameters, and to communicate effectively with process support personnel so appropriate and timely corrective action can be initiated.

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4. GOOD PRACTICES

4.1 Operator Responsibilities

Management should establish written guidance specifying personnel responsibilities related to unique processes. Typical operator responsibilities include:

- Monitoring applicable unique process parameters, as indicated by the instrumentation related to systems under the operator's control

- Identifying trends, out-of-specification parameters, or adverse conditions, and initiating appropriate corrective action

- Consulting with process support personnel (those responsible for the unique process) and coordinating activities

- Identifying the status of unique processes as part of operations turnover.

4.2 Operator Knowledge

Operating personnel should be knowledgeable about unique processes, especially aspects relating to process safety, that are affected by their work or that affect the workplace environment. This integrated knowledge enhances their ability to understand trends, problems, or potential problems. Such knowledge increases their ability to initiate corrective action, or to inform the process support personnel of the situation, and enables them to understand how their actions may affect the unique process.

Integrated knowledge can be developed through training, experience, and communication. Facilities having formal training programs should include topics that provide a fundamental understanding of unique processes. Training should address the process theory, system

design and components, and operating characteristics. Personnel whose job interfaces with specific unique processes may benefit from additional training in one or more of the following subject areas:

- Chemistry
- Electricity and/or Electronics
- Heat Transfer and Fluid Flow
- Mathematics
- Physics (classical and/or nuclear)
- Industrial Safety

For example: the operator of an emergency diesel generator is not responsible for operation of the cooling water supply system; however, the operator may benefit from fundamental training in heat transfer and fluid flow to better understand the impact of diesel generator operation on the cooling water system flows and temperatures.

One effective method for identifying specific training needs and developing appropriate training material is the systematic approach to training (SAT). Certain DOE facilities are required to implement SAT, and extensive documentation has been prepared to assist facilities in this process. Appendix A identifies some of the resources available for implementing SAT.

Appendix A also lists some of the training materials that are available for study in certain fundamental subject areas. These materials are designed to be used in individual self-paced study, so they may be used as part of a formal or informal training program.

Many facilities over the years have used cross-training, i.e., training in some aspects of others' job responsibilities, to familiarize personnel with interfacing or unique processes. Cross-training may be part of a formal training program, or it may be performed by rotating personnel to different shift positions as part of an overall familiarization.

Work experience gained through support of, or interface with, unique processes can enhance the integrated knowledge obtained through other methods. In some cases, direct communication between operators and process support personnel may be all that is necessary to ensure that the operator is aware of and considers the potential effects on unique processes.

4.3 Operator Response to Process Problems

Personnel should be able to analyze process-related problems and take appropriate, timely corrective actions. Proper response to process problems requires more than application of procedures. An understanding of the process is necessary in order to correctly interpret parameters and determine the appropriate response. Personnel should also be able to:

- Anticipate the response in interacting systems or unique processes when changes are made to a process under their control

- Anticipate changes in processes under their control in response to changes in processes controlled by others

- Monitor facility conditions (including trends in operations), analyze available information, and diagnose problems

- Evaluate degrading conditions and take appropriate action to prevent the potential consequences

- Recognize the symptoms of abnormal and emergency conditions and prevent or minimize the consequences.

4.4 Communication between Operators and Process Personnel

Open lines of communication must exist between operators and process support personnel. Prior to beginning activities that could affect a unique process, an operator should contact the appropriate process support personnel. This will enable work groups to coordinate interrelated activities. For the same reason, supervisors should include personnel from all affected activities in pre-job planning sessions and briefings.

During abnormal and emergency situations, it is essential that all work groups function as a team to provide prompt corrective action. For groups of personnel to function effectively as a team, the individuals must possess both technical and teamwork skills. Team deficiencies, such as communications, considered insignificant during normal operations, become major obstacles to making decisions and initiating appropriate corrective actions during abnormal conditions. Effective communication between work groups, therefore, is an essential aspect of teamwork, and is vitally important to safe and reliable operations.

APPENDIX A

OPERATOR KNOWLEDGE RESOURCE LIST

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OPERATOR KNOWLEDGE RESOURCE LIST

The following documents provide information helpful for establishing a systematic approach to training (SAT) program.

DOE-HDBK-1001-96	*Guide to Good Practices for Training and Qualification of Instructors*
DOE-HDBK-1002-96	*Guide to Good Practices for Training and Qualification of Chemical Operators*
DOE-HDBK-1003-96	*Guide to Good Practices for Training and Qualification of Maintenance Personnel*
DOE-HDBK-1078-94	*Training Program Handbook: A Systematic Approach to Training*
DOE-HDBK-1116-98	*Guide to Good Practices for Developing and Conducting Case Studies*
DOE-HDBK-1200-97	*Guide to Good Practices for Developing Learning Objectives*
DOE-HDBK-1201-97	*Guide to Good Practices: Evaluation Instrument Examples*
DOE-HDBK-1202-97	*Guide to Good Practices for Teamwork Training and Diagnostic Skills Development*
DOE-HDBK-1203-97	*Guide to Good Practices for Training of Technical Staff and Managers*
DOE-HDBK-1204-97	*Guide to Good Practices for the Development of Test Items*
DOE-HDBK-1205-97	*Guide to Good Practices for the Design, Development, and Implementation of Examinations*
DOE-HDBK-1206-98	*Guide to Good Practices for On-the-Job Training*

DOE-STD-1057-93	*Guide to Good Practices for the Selection, Training, and Qualification of Shift Technical Advisors*
DOE-STD-1059-93	*Guide to Good Practices for Maintenance Supervisor Selection and Development*
DOE-STD-1060-93	*Guide to Good Practices for Continuing Training*
DOE-STD-1061-93	*Guide to Good Practices for the Selection, Training, and Qualification of Shift Supervisors*
DOE-STD-7501-95	*Development of DOE Lessons Learned Programs*

The following DOE Fundamentals Handbooks may be helpful in the development and presentation of fundamentals training, and may be used for individual self-paced study on a continuing basis.

DOE-HDBK-1010-92	*Classical Physics*
DOE-HDBK-1011/1-92	*Electrical Science*, Volume 1 of 4
DOE-HDBK-1011/2-92	*Electrical Science*, Volume 2 of 4
DOE-HDBK-1011/3-92	*Electrical Science*, Volume 3 of 4
DOE-HDBK-1011/4-92	*Electrical Science*, Volume 4 of 4
DOE-HDBK-1012/1-92	*Thermodynamics, Heat Transfer, and Fluid Flow*, Volume 1 of 3
DOE-HDBK-1012/2-92	*Thermodynamics, Heat Transfer, and Fluid Flow*, Volume 2 of 3
DOE-HDBK-1012/3-92	*Thermodynamics, Heat Transfer, and Fluid Flow*, Volume 3 of 3
DOE-HDBK-1013/1-92	*Instrumentation and Control*, Volume 1 of 2
DOE-HDBK-1013/2-92	*Instrumentation and Control*, Volume 2 of 2

DOE-HDBK-1014/1-92	*Mathematics*, Volume 1 of 2
DOE-HDBK-1014/2-92	*Mathematics*, Volume 2 of 2
DOE-HDBK-1015/1-92	*Chemistry*, Volume 1 of 2
DOE-HDBK-1015/2-92	*Chemistry*, Volume 2 of 2
DOE-HDBK-1016/1-92	*Engineering Symbology, Prints, and Drawings*, Volume 1 of 2
DOE-HDBK-1016/2-92	*Engineering Symbology, Prints, and Drawings*, Volume 2 of 2
DOE-HDBK-1017/1-92	*Material Science*, Volume 1 of 2
DOE-HDBK-1017/2-92	*Material Science*, Volume 2 of 2
DOE-HDBK-1018/1-92	*Mechanical Science*, Volume 1 of 2
DOE-HDBK-1018/2-92	*Mechanical Science*, Volume 2 of 2
DOE-HDBK-1019/1-92	*Nuclear Physics and Reactor Theory*, Volume 1 of 2
DOE-HDBK-1019/2-92	*Nuclear Physics and Reactor Theory*, Volume 2 of 2

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CONCLUDING MATERIAL

Review Activities:

DOE

DP

EH

EM

ER

NE

NS

Preparing Activity:

DOE-EH-31

Project Number:

MISC-0009

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DOE STANDARD

GUIDE TO GOOD PRACTICES FOR OPERATIONS TURNOVER

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

AREA MISC

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Guide to Good Practices for Operations Turnover

Page/Section	Change
Concluding Material	The Preparing Activity was changed from NE-73 to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

KEYWORDS

Operating Base

Turnover

Turnover Checklist

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SAMPLE TURNOVER CHECKLIST FORMAT A-1

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DEFINITIONS

Narrative Log	A chronological narrative record of events or functions.
Operating Base	The area within a work station (e.g., office, desk, workbench) where a person returns to when not performing other duties (e.g., tours, maintenance, testing).
Operator	A qualified person assigned specific responsibilities related to the operation of facility process systems and equipment.
Personnel Briefing	A meeting of all shift and support activity personnel, held at the beginning of each shift, during which the cognizant supervisor explains facility status and work priorities.
Round Sheet (Round Inspection Sheet)	A type of data-collection sheet used to record key equipment and system parameters, (e.g., readings from instruments and gauges), and operating status (whether operating or shutdown for maintenance or repair) during equipment inspection tours (rounds).
Shift	The normal period of work for an individual or group (e.g., 8:00 a.m. to 5:00 p.m.).
Stable Condition	Period of time when no activities (e.g., surveillances, process rate changes, equipment changes) are in progress that require continuous personnel attention or possible response.
Status Control Board	A device (e.g., a laminated sheet, plexiglass board) that lists major equipment and systems of a work station or facility, and indicates their status.

Surveillance	A test, calibration, or inspection that ensures the necessary operability and quality of safety-related items required for the safe operation of a facility.
Turnover (Operations Shift Turnover)	The process of formally transferring duties and responsibilities from one person to another.
Turnover Checklist	A form developed for a specific shift position and used by personnel to aid the turnover process; provides a convenient method of denoting equipment in service, surveillances in progress, technical safety requirement status, and documents on-coming personnel should review to ensure a complete transfer of facility status information.
Walkdown	A tour or inspection of a work station.
Work Station	The physical area, equipment, and systems for which a person is assigned responsibility.

GUIDE TO GOOD PRACTICES FOR OPERATIONS TURNOVER

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Operations Turnover, Chapter XII of Department of Energy (DOE) Order 5480.19, Conduct of Operations Requirements for DOE Facilities. The practices in this guide should be considered when planning or reviewing operations turnover programs. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Operations Turnover" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for a formal operations turnover program to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

Turnovers that provide on-coming personnel with an accurate status of their work stations are systematically performed.

Criteria:

a. Supervisory personnel and specified work station operators use a checklist in the turnover process.

b. On-coming personnel review specified documents prior to assuming responsibility for the work station.

c. Walkdowns of appropriate control panels are conducted by on-coming personnel.

d. A discussion of facility status occurs between off-going and on-coming personnel prior to transferring work station responsibility.

e. On-coming supervisors conduct personnel briefings as required.

f. Turnovers occurring during the shift are as thorough as necessary to ensure a complete transfer of work station information.

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3. DISCUSSION

An operations shift turnover (turnover) is the process of transferring duties and responsibilities of facility job positions between personnel. Thorough turnovers are crucial to the safety of DOE facility operation. Turnover activities ensure that on-coming personnel have an accurate picture of current facility status and provides a review of past and scheduled operations. The information obtained by on-coming personnel during turnovers promotes safe, efficient, and continuous operation. To ensure the most efficient and productive transfer of facility information, the turnover should be strictly focused on the work station status and operation.

The turnover process should be conducted in a formal, businesslike manner because it prepares on-coming personnel to operate the facility. Consistent with facility policy, on-coming personnel are responsible for arriving at the facility in a condition ready to work (i.e., physically and mentally fit to assume the duties of the job).

A turnover checklist enhances the turnover process by serving as a guide for the on-coming person. Used properly, the checklist will take the on-coming person through the turnover process step-by-step. The turnover process will thus become a standard routine, thereby minimizing the possibility of missing important information during the turnover.

Documents specified by management should be reviewed by on-coming personnel before accepting their assigned responsibility. Reviewing these documents will augment the information obtained during the remainder of the turnover. The review will refresh and supplement the on-coming person's knowledge of past operations, as well as present and scheduled operational commitments. It can also provide information about work station status. This is especially important when a person has been absent for several days.

A pre-shift walkdown allows the on-coming person to inspect the work station before accepting responsibility. It provides the on-coming person an opportunity to check the status of the area and associated equipment. The walkdown is most beneficial when the off-going

person accompanies the on-coming person. This enables the on-coming person to ask questions regarding work station status and also obtain immediate feedback.

A discussion of all information concerning the work station must be accomplished and the on-coming and off-going personnel must be confident that an appropriate information exchange has taken place prior to transferring responsibility. If properly focused, this discussion is the most effective method of communicating work station information to the on-coming person. After the discussion, a formal transfer of the duties and responsibilities of the work station should conclude the turnover. This will officially end the duties and responsibilities of the off-going person and start those of the on-coming person.

Personnel briefings reinforce information communicated during the turnover. During the briefing, the appropriate supervisor has the chance to provide personnel with a picture of overall facility operations, both current and planned, including support group activities. A briefing of all personnel is the best way to quickly disseminate information important to everyone, and also address questions personnel have concerning the facility.

In addition to turnovers to persons working a rotating schedule, turnovers to a staffed/unstaffed condition (e.g., office, laboratory, and research personnel) should also be considered. These single-shift positions should be considered because illness, vacation, or other instances may require that a work station be filled by an alternate person. The alternate must have sufficient knowledge of work station status to maintain operational continuity during the other person's absence. In this case, the transfer of information may only require written communication, but should still be communicated.

The information contained in this document complements the guidelines of Shift Routines and Operating Practices, Chapter II, Control Area Activities, Chapter III, and Logkeeping, Chapter XI, of DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

4. GOOD PRACTICES

The turnover process should actually begin as soon as the "on-duty" person has assumed the duties and responsibilities for the work station. At that time, the operator or supervisor should begin identifying information that may be helpful to the next turnover. As information is acquired, it should be recorded in the appropriate log and round sheets and on status boards, if applicable.

At shift change, the on-coming person should review the appropriate logs, round sheets, status boards and other facility required documentation to gain insight into past, present and future work station status. A turnover checklist might be helpful to guide the on-coming person through the turnover, as well as guide the off-going person in preparing information for the turnover process. To acquire first hand knowledge of present work station conditions, the on-coming person should walk through the entire work station. After walking through the work station, the on-coming and off-going person should then perform an information exchange. When all pertinent information has been exchanged, the off-going person should turn over the duties and responsibilities to the on-coming person. The on-coming person should then accept the duties and responsibilities, which, in turn starts the process over again.

A shift personnel briefing, conducted by the supervisor, should also be a part of the turnover process. This briefing should provide the on-coming person with additional facility-wide information and should supply him/her with an overview of facility operations for the upcoming shift.

4.1 Turnover Checklists

Turnover checklists should be developed to aid in the turnover process. The content of the checklist should reflect the duties and responsibilities of the position, e.g., supervisor or operator, and will normally be developed on a case-by-case basis. Determining the need for checklists should be dictated by experience or through evaluation of activities performed at the individual work stations and their impact on

facility operations. Checklists should be used as a guide during each turnover to ensure a thorough turnover of facility status and work station information. All personnel using turnover checklists should be trained on their use and importance. This training should include an explanation of how and when to complete the checklists.

The turnover checklist should include information that is necessary for a thorough turnover, especially information that may not be readily apparent to the on-coming person. The detail of the checklist should be consistent with the risk of the operations performed at the associated work station. Sufficient space should be allowed for adding pertinent information not covered by the checklist.

Turnover checklists may come in different forms. Two popular forms are paper sheets that can be used once and laminated sheets that can be reused. Paper sheets are inexpensive to reproduce and special writing instruments are not required for marking. They are subject to work station conditions and may become damaged or unreadable (e.g., oil and grease stains, dirt). Laminated sheets are useful if checklist information is delineated by boxes (e.g., Pump 1 **:** ON **9** OFF, **:** Reviewed Status Board). They do require erasable markers or "grease" pencils for marking, which does make writing somewhat more difficult. Each facility should decide the form that best suits its needs.

4.1.1 Turnover Checklist Verification

A program should be in place to ensure that all turnover checklists are current and maintained correctly. Responsibility for developing and maintaining turnover checklists should be designated by management. Personnel should be involved in the development of their work station turnover checklist and should supply information if changes are necessary.

A master copy of each checklist should be kept for ease of updating and also for restocking the checklists as needed. Changes to checklists should be communicated to

the appropriate work station personnel. As checklists are revised, out-dated copies should be discarded. Blank checklists should be readily available to personnel.

4.1.2 Turnover Checklist Information

As a minimum, each turnover checklist should include the applicable work station name and approval designation (e.g., revision number, approval-for-use signatures and dates). Appendix A shows an example of approval designation. There should be a space for recording the date and time the checklist was used and spaces for the on-coming and off-going persons to sign. Providing a space for the date and time is a good practice to prevent confusion when using the checklist (i.e., if a previously used checklist was not discarded, it will have a date and time that is different from the expected).

A graded approach philosophy, consistent with the risk of operations at each work station, should be used to develop turnover checklists. Answering the following question is useful when deciding whether to include information on the checklist: "What are the potential environmental, safety, health, and operational risks of forgetting to turn over this information?" The operational risks should focus on the information required to ensure continuity of operation. Checklist information should be as comprehensive as necessary to ensure that the on-coming person is provided with sufficient information to adequately control the work station immediately following the turnover. Examples of checklist information may include:

- Facility status
- Technical safety requirements in effect, including time limits
- Status of important operating parameters and other parameters as appropriate
- Status of safety equipment and other equipment as appropriate (e.g., operating, standby, out-of-service)

- Required chemistry or process sample times
- Equipment problems
- Times specific planned actions are required
- Changes in radiological or hazardous materials areas and conditions
- Temporary procedure changes in effect
- Facility support group activities (e.g., construction, radiation protection)
- Maintenance, testing, and evolution status (e.g., completed, in progress, or planned)
- Status of controlled keys
- Abnormal lineups or conditions
- Documents to be reviewed (e.g., narrative logs, round sheets)

If a status board is used to track equipment and system status at a work station, the turnover checklist should direct personnel to review the status board. It is not the intent of the checklist to duplicate this information. The checklist should guide personnel through the turnover, supplying pointers, as necessary, to information that already exists.

Each turnover checklist should include a section for additional information. This section may be used for listing danger, caution, out of calibration, out of specification, and deficiency tags hanging at the work station. This space may also be used to list and explain temporary systems installed at the work station. Other uses for the additional information section may include listing temporary modifications such as:

- Electrical jumpers
- Lifted leads

- Circuit boards removed
- Disabled annunciators/alarms
- Mechanical jumpers/bypasses
- Temporary setpoint changes
- Installed or removed blank flanges
- Disabled relief or safety valves
- Installed or removed filters or strainers
- Plugged floor drains
- Temporary pipe supports.

When documents are to be reviewed as part of the turnover, there should be a section listing the documents and space to document the review. Occasionally, additional documents may need to be reviewed, therefore, space for adding those documents should be included. Refer to Section 4.2, Document Review, for a listing of typical documents for review.

Checklists developed for supervisory positions should include a summary of activities of assigned personnel. This summary should help prepare an on-coming supervisor for the pre-shift walkdown.

4.1.3 Using Turnover Checklists

Items on the turnover checklist should be updated, as necessary, throughout the shift. As events occur, conditions change, or information pertinent to the turnover is obtained, entries can be made on the checklist as a reminder to discuss the information at turnover. Just prior to turnover, the off-going person should verify that the off-going portion of the turnover checklist is current and complete.

The turnover checklist should be given to the on-coming person prior to starting the turnover process. The on-coming person should review the checklist before commencing a pre-shift walkdown and should use the checklist during the pre-shift walkdown. A provision may be made to have the off-going and on-coming person sign the checklist when it's complete.

Supervisors should ensure that turnover checklists are properly used by periodically monitoring subordinate work station turnovers and reviewing completed checklists. They should also ensure used checklists are properly discarded.

4.2 Document Review

On-coming personnel should review documents specified by management prior to assuming responsibility for their shift positions. If a checklist is specified to be used by a work station, a list of these documents should appear on the checklist. Reviewing the turnover checklist must not serve as a substitute for log reviews.

Document review should be as intensive as necessary to ensure on-coming personnel understand important history, present status, and scheduled events. To ensure on-coming personnel understand events that have occurred, narrative log entries should be reviewed since they last worked. Status logs (e.g., equipment, tagout, modification) should be reviewed so on-coming personnel are familiar with all active entries, with an emphasis on what has changed since they last worked. Other documents describing important aspects of overall facility status should also be reviewed by all on-coming personnel. For personnel returning from vacation or some other extended absence (including fifth or training shift), document review requirements should be more rigorous, as appropriate, to ensure that they have a thorough understanding of facility status.

Examples of documents to review include:

- Work station narrative log
- Equipment status log
- Tagout log
- Work station round/inspection sheets
- Temporary modification and jumper logs
- Out-of-service annunciator log
- Operational limit action log
- Shift orders book (Timely Orders)

In addition to the above documents, supervisors may need to review the narrative and round/inspection sheets of assigned personnel. This review can often provide detailed information concerning the operations and equipment status, supplementing the records maintained by the off-going supervisor. Supervisors may have additional responsibilities for document review, in accordance with facility operating procedures.

4.3 Pre-Shift Walkdown

A pre-shift walkdown of the work station should be conducted as a part of the turnover process. The walkdown should include a brief look at all areas of the work station. On-coming personnel should check the status of equipment, systems, and panels. The walkdown should also check the status of work being performed at the work station. Status control boards should be verified and updated during the walkdown.

4.3.1 Panel Walkdown

Prior to assuming responsibility for the work station, the on-coming person should personally verify the status of important system operating parameters. Walkdowns of appropriate instrumentation and control panels, especially those relating to safety systems, should be conducted at each work station. The purpose of a panel walkdown is to determine facility status through observing system lineups, switch positions, lighted annunciators, chart recorders, and status lights.

On-coming and off-going persons should conduct the walkdown together during the turnover. A discussion of work station status, trends, and potential problems should occur during this walkdown. The turnover checklist, if specified to be used by the work station, should be used as an aid in this discussion. As a minimum, the discussion should be focused on items observed during the walkdown, for example:

- Status of safety-related equipment
- Running equipment
- Inoperable equipment, including instrumentation
- Technical safety requirements, including surveillance requirements
- Reasons for actuated alarms or annunciators
- Tagged equipment, including any surveillance/equipment work in progress
- Abnormal equipment and component configurations.

It is the responsibility of the off-going person to communicate all pertinent information about the work station to the on-coming person during the walkdown. The on-coming person should inquire about unfamiliar lineups, positions, indications, and tags observed during the walkdown.

4.3.2 Supervisor Walkdown

On-coming supervisors should walk down the instrumentation and control panels under their purview as a part of the turnover. This walkdown may be done with the off-going supervisor, separately, or with either off-going or on-coming personnel assigned to the work stations under the supervisor's purview. The walkdown can occur before, during, or shortly after turnover, but will produce a better information exchange if performed before the turnover.

4.4 Information Exchange and Responsibility Transfer

As a minimum, a verbal exchange of information between the off-going person and a qualified relief should conclude the turnover. This information exchange (discussion) should occur when work station conditions are stable. The discussion should be performed immediately before the exchange of responsibility and within the confines of the work station. In addition, during the period of information exchange, access into control areas should be limited so control area personnel remain focused on the exchange, while simultaneously monitoring and controlling the facility. For more information on control area activities, refer to Chapter III, “Control Area Activities,” DOE Order 5480.19.

The off-going person should use the discussion time to explain any unusual events that have occurred, planned maintenance and surveillance activities, and any other pertinent information not covered during the walkdown or by the turnover checklist (if applicable). The on-coming person should use this time to resolve any questions concerning the status of the facility, ongoing maintenance or surveillances, log entries, and written guidance for the continued operation of the facility during the upcoming shift.

An operating base should be established for each work station. The information exchange and responsibility transfer should take place at this operating base.

Management should take into account the noise level and the radiation and hazardous material conditions present before approving a location for an operating base. Since abnormal situations may dictate that turnovers be performed outside of the operating base (e.g., construction at the operating base, special evolutions and tests that require continual attention), management should allow the use of alternate areas. Personnel should inform their supervisors prior to switching areas.

Prior to the transfer of responsibility, the off-going person should make a decision about the physical and mental state (e.g., alert, coherent) of the on-coming person. Each facility should establish guidance concerning the physical and mental requirements for assuming work station responsibility. If the off-going person believes the on-coming person cannot manage the duties and responsibilities of the work station, the off-going person should retain the duties and responsibilities and should immediately notify the appropriate supervisor. The facility's organization and administration guidelines should include a policy for handling this situation.

When the off-going person is satisfied that the on-coming person is fully cognizant of the facility conditions, the off-going person should so inform the on-coming person. The on-coming person should then signify to the off-going person he/she is assuming the responsibility for the work station and document the transfer with an entry in the appropriate log in accordance with Chapter XI, Logkeeping, of DOE Order 5480.19. The off-going person should not leave the work station until the on-coming person has accepted and signed for the duties and responsibilities.

4.5 Personnel Briefing

Facility policies and procedures should establish guidance pertaining to the time, place, and conduct of personnel briefings. Personnel briefings should occur at a specified time and place and all facility personnel should understand the importance of attending the briefing. Briefings should be formal and as short as necessary to communicate pertinent information and not interfere with facility operational commitments.

A briefing of shift personnel should occur as part of the turnover process. It is advisable to have all shift personnel at this briefing. If it is not feasible to conduct a personnel briefing with all personnel, then at least a briefing of all supervisors should occur as part of the turnover. Each supervisor would then be responsible for disseminating the information to their assigned personnel.

This form of briefing should be used only if it is not possible to gather all personnel in one place at the same time.

If, as a result of operational commitments, some personnel cannot attend the briefing, arrangements should be made to pass on briefing information to these persons. Supervisors could pass on the information as previously discussed or communication devices, such as telephone or intercom, could be used to allow those persons absent from the briefing to listen to the briefing from their work station. Failure to attend briefings for non-operational commitments, such as performing administrative duties, should be discouraged.

When determining the time for the briefing (i.e., either before or after the turnover at individual work stations), management should take into consideration the type of operation, extent or layout of the facility, extent of required shift overlap, and labor union contracts, where applicable. If an emergency or abnormal situation occurs which might have an impact on the turnover, an attempt should be made to contact on-coming shift personnel to alert them to the situation and also to notify them of any alterations to the personnel briefing. In such cases, personnel briefings may be longer and more in-depth.

In addition to shift personnel, personnel from support groups (e.g., contractors, vendors, engineering support, and maintenance groups) should attend briefings when their activities can directly affect operations. This practice results in a better understanding of shift priorities and objectives among shift and support group personnel.

For facilities that work only one shift (i.e., dayshift), this briefing may take the form of a morning staff meeting. This is especially helpful if there are a number of different activities occurring, which might affect each other, or if there are new personnel filling in for absent personnel (e.g., due to vacation, sickness, or temporary job priority change).

The briefing should be conducted by the appropriate supervisor and should include a review of facility status, problems with equipment, and evolutions in progress or planned for the shift. The detail of the briefing should be consistent with the amount and type of work occurring or scheduled. Additional items to cover during the briefing may include:

- Shift orders
- Lessons learned from events occurring elsewhere or during other shifts
- Last-minute changes in facility status or operational functions planned for the shift
- Support group work planned for the shift (e.g., maintenance, construction)
- Changes to administrative procedures that impact methods of doing work, or changing procedural requirements
- Facility maintenance shutdown schedule changes
- Work/production goals for the shift
- Other important work-related items.

Personnel briefings following days off, during times of facility shutdown, and during periods of intense support group activity may be more extensive.

4.6 Reliefs Occurring During the Shift

Turnovers (reliefs) occurring during the shift should meet the same objective as a turnover at the beginning of the shift (i.e., providing the on-coming person with an accurate status of the work station). Facility procedures should establish the requirements for relief of duties and responsibilities during the shift. If a turnover checklist is used at the work station for normal shift turnovers, that checklist or portions of it may also be considered for these reliefs.

If a relief is necessary, the cognizant supervisor should be informed of the reason and expected length of time before the off-going person turns over the work station duties and responsibilities. Before authorizing the relief, the cognizant supervisor should ensure the on-coming person is qualified and should verify that facility conditions permit the relief (e.g., enough personnel to staff the fire brigade or other special emergency response group). This is especially important during back shifts, when staffing may be lower.

At a minimum, the following turnover policies should be followed:

- The transfer of duties and responsibilities should occur at a time when facility conditions are stable

- The off-going person should be confident that the on-coming person is fully capable of assuming the duties and responsibilities of the work station

- At the end of the turnover the on-coming person should signify to the off-going person that he/she is assuming the responsibility for the work station and document the transfer with an entry in the appropriate log in accordance with Chapter XI, Logkeeping, of DOE Order 5480.19.

Depending on the work station, an instrumentation and control panel walkdown and document review may be necessary. The breadth and depth of the mid-shift turnover will depend on the safety importance of the job, the on-coming person's familiarity with the work station, the length of time since the on-coming person has performed the duties and responsibilities of the work station, and the activities occurring at the work station.

If a transfer of responsibility is necessary because of a physical injury, a qualified relief should assume responsibility for the work station and perform a full panel walkdown, log review, and review the most recent turnover checklist to gain the knowledge of present work station conditions. To ensure the best exchange of facility information, a discussion with the cognizant supervisor should also be performed.

4.7 Turnover to a Staffed/Unstaffed Condition

The principles of operation turnover should also apply when the status of the facility or process is changing to a staffed/unstaffed status (e.g., single or periodic shift operation). Before placing the facility or operation in an unstaffed status (e.g., after single-shift operation), off-going personnel should ensure that the facility or operation is in a safe and stable configuration approved by appropriate management and the narrative log accurately reflects that status. A turnover checklist may be used in conjunction with the narrative log to convey information. Work station information should be in sufficient detail to allow any person, qualified at that work station, to assume the position after reviewing the narrative log and turnover checklist. Since a verbal exchange of information may not occur between the off-going and on-coming personnel in this instance, the recorded information should be as clear and concise as if a face-to-face relief had occurred.

SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter II, "Shift Routines and Operating Practices."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter III, "Control Area Activities."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XI, "Logkeeping."

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APPENDIX A

SAMPLE TURNOVER CHECKLIST FORMAT

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WORK STATION 'A' TURNOVER CHECKLIST

Approved by: _____ Approval Date: _____

Shift: ☐ N ☐ D ☐ E Date: _____

☐ Facility Status:_____

☐ Evolutions: (completed/in progress/planned)

_____
_____
_____
_____

☐ General Information: (e.g., abnormal lineups, special instructions/considerations)

_____
_____
_____
_____
_____

☐ Equipment Status: (e.g., equipment deficiencies, equipment currently out of service/special precautions, surveillances or tests in progress, equipment maintenance in progress, maintenance completed/restoration measures outstanding)

_____
_____
_____
_____
_____

☐ Status of Controlled Key(s) :_____
_____

Document Review:

- ☐ Narrative Log
- ☐ Tagout Log
- ☐ Round Sheets
- ☐ Temporary Modification Log
- ☐ _____
- ☐ Equipment Status Log
- ☐ Shift Orders
- ☐ Operational Limits Action Log
- ☐ _____
- ☐ _____

Additional Remarks:

_____
_____
_____
_____
_____
_____

On-coming: _____ Off-going: _____

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DOE-STD-1038-93

CONCLUDING MATERIAL

Review Activities:

DOE
DP
EH
EM
ER
NE
NS

Preparing Activity:

DOE-EH-31

Project Number:

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March 1993
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December 1998

DOE STANDARD

GUIDE TO GOOD PRACTICES FOR CONTROL OF EQUIPMENT AND SYSTEM STATUS

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

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Guide to Good Practices for Control of Equipment and System Status

Page / Section	Change
p. 10 / Section 4.3 / second paragraph	The reference to DOE-STD-1030-92 was updated to the current document—DOE-STD-1030-96.
p. 12 / Section 4.6 / first paragraph	The reference to DOE Order 4330.4A was updated to the current document—DOE Order 4330.4B.
p. 17 / Supplemental Resources	The reference to DOE Order 4330.4A was updated to the current document—DOE Order 4330.4B.
p. 17 / Supplemental Resources	The reference to DOE-STD-1030-92 was updated to the current document—DOE-STD-1030-96.
Concluding Material	The Preparing Activity was changed from NE-73 to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*.

KEYWORDS

Operations Supervisor
Round Sheet
Status

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DEFINITIONS

Caution Tag	Tag used to indicate some precaution or item of information that must be known prior to operating a component or system. Caution tags may be used on functional components or systems. Caution tags are NOT to be used for protecting personnel (i.e., do not use caution tags where it is appropriate to use a danger tag and lockout device).
Log (Narrative Log)	A chronological narrative record of events or functions.
Operations	The business activity of the facility and assigned personnel, e.g., controlling process equipment, producing/assembling components, performing tests, conducting experiments, processing information, etc.
Operations Supervisor	The individual having authority and responsibility for operational control of a facility, process, experiment, or other project.
Round Sheet (Round Inspection Sheet)	A type of data-collection sheet used to record key equipment and system parameters (e.g., readings from instruments and gauges) and operating status (whether operating or shutdown for maintenance or repair) during equipment inspection tours (rounds).
Shift	The normal period of work for an individual or group (e.g., 8:00 a.m. to 5:00)
Status	The operational condition or state of readiness of equipment or systems (e.g., on-line, standby, unavailable).

Surveillance	A test, calibration, or inspection that ensures the necessary operability and quality of safety-related items required for safe operation of a facility.

GUIDE TO GOOD PRACTICES FOR CONTROL OF EQUIPMENT AND SYSTEM STATUS

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Control of Equipment and System Status, Chapter VIII of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The practices in this guide should be considered when planning or reviewing equipment and system status control programs. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Control of Equipment and System Status" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the need for a formal status control program to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

Facility configuration is properly maintained by methods that control equipment and system status.

Criteria:

a. The operations supervisor maintains proper facility configuration, including authorizing changes to equipment and system status.

b. A system is in place to ensure and document proper alignment of equipment and systems prior to placing them in service.

c. A lockout/tagout program is in place to provide protection to personnel and equipment and to aid in the control of equipment and system status.

d. Administrative controls are established to document compliance with operational limits.

e. Operating personnel receive accurate information reflecting the status of control panel and local panel alarms.

f. A system is in place to document equipment deficiencies.

g. All activities (including maintenance) on equipment that are important to safety, that affect operations, or that change control indications or alarms, are properly analyzed, documented, and authorized.

h. Operational testing is performed following maintenance to demonstrate that equipment and systems are capable of performing their intended function.

i. A system is in place to control temporary modifications to facility equipment or systems.

j. A document control system is in place that ensures operating personnel have the latest revision to documents necessary for proper control of equipment and systems.

3. DISCUSSION

DOE facilities are required to establish administrative programs to control equipment and system status. A program for controlling equipment and system status, or status control, must be broad in scope. It should incorporate measures to ensure awareness by operating personnel concerning the physical configuration and operating status of equipment and systems. It should contain methods to maintain system operability in accordance with design requirements. DOE Order 5480.19 addresses several individual programs that comprise portions of the status control program, including Lockouts and Tagouts (Chapter IX), Independent Verification (Chapter X), Logkeeping (Chapter XI), and Operations Turnover (Chapter XII). These programs assist in establishing effective control of equipment and system status and are appropriately referenced within this guide.

Proper control of equipment and systems requires clear lines of responsibility and authority. The facility status control program should clearly designate the authority and responsibility for controlling status to ensure proper configuration. All personnel must understand the importance of keeping the operations supervisor and other designated operations personnel informed of activities that could affect the status or operability of equipment.

Effective control of equipment and system status also means coordinating operations and maintenance activities. Equipment deficiencies must be promptly identified for correction in the work control system. Locking and tagging should be performed by qualified operations personnel to ensure that all energy and hazardous material sources are properly isolated, and required safety functions are not inadvertently disabled. The operations supervisor should sign the work control documents to authorize the start of all maintenance activities, including testing, calibration, and related activities. A process for post-maintenance testing should be in place to ensure that all operation of equipment is controlled by approved operating procedures and that appropriate maintenance and operations personnel are represented during the testing. The status or alignment of equipment should be verified as part of restoring the equipment to service following outages for maintenance or design modifications.

Special administrative controls are required whenever equipment must be operated with temporary modifications (e.g., jumpers, blocks, bypasses) in place. These controls should include methods for ensuring that operators are aware of the modified status of the equipment and its operating limitations. The controls should provide for appropriate safety and technical reviews, documentation, updating of procedures and drawings, and training.

The status control program requires specific methods for verifying and documenting the configuration of equipment and systems, changes in equipment status, and compliance with operational and safety limits. Status control documentation may include checklists, logs, status boards, or a combination of these. Requirements for status control documentation should be coordinated with other documentation requirements (e.g., logkeeping) to avoid unnecessary forms or duplication of information. This ensures that status information is updated as a regular part of the job, not treated as an added administrative task. It also provides those personnel having operating responsibility with simple, direct access to current status information.

4. GOOD PRACTICES

4.1 Status Change Authorization and Reporting

An effective program for control of equipment and system status must be based upon the designation of responsibility for status control and authority to effect status changes. During the operation of any facility process or project, there must be one individual who is responsible for operational control and who has authority to make changes. Within this guide, that person will be referred to as the operations supervisor.

The operations supervisor is typically the senior operating person present. The supervisor is tasked with maintaining a broad perspective of all facility operations; however, when abnormal or emergency conditions occur, the supervisor's response must be based on current knowledge of system status. Therefore, changes in the status of safety-related systems or other equipment critical to the operation of the facility should be pre-authorized by the operations supervisor.

This means that the supervisor's perspective of status must be the focal point for all operations. Status updates to the supervisor may be required, even for actions that have already been authorized. For example: during the morning shift briefing, a supervisor gives instructions for operational testing of a control system, to be performed later during that shift. In the afternoon, when the operator or technician is ready to begin the test, it is appropriate to check back with the supervisor, both to verify that the process or equipment status still supports the test, and to inform the supervisor of the current status.

To facilitate operation of equipment or processes, the operations supervisor may delegate the authority to operate and make status changes in systems or equipment that are not critical to facility safety or process output. When delegating authority to operate, the supervisor must also ensure that all pertinent operating information is provided to the designated operator in charge. Each designated operator must ensure that the supervisor is periodically updated on the status of the delegated systems.

The operations supervisor should ensure that all facility personnel are aware of the potential impact their activities may have on the status of equipment and systems, and that they obtain concurrence prior to beginning work that could change the status of equipment. Any status changes that occur during the progress of work should be reported to the responsible operator or the operations supervisor. Additional guidance concerning the reporting of process- and status-related information is contained in DOE Order 5480.19, Chapter XIII, "Operations Aspects of Facility Chemistry and Unique Processes."

4.2 Equipment and System Alignment

Operations personnel should be aware of the alignment of systems and equipment within their area, whatever the current mode of operation (i.e., startup, shutdown, normal operations, or maintenance). Alignment checklists should be developed for all modes of operation and incorporated into the appropriate procedures. These checklists should be used as guides for operators to use in establishing the correct component positions when placing systems and equipment into service or other operating modes. They should identify each component by the exact name and identifying number that appears on the component label. They should identify the required alignment position (e.g., open, shut, on, off), make provision for signature or initials verifying the component position, and provide space to annotate any deviation.

The frequency for performing or verifying system alignments depends on the level of control required and the level of operating activity. For example, if a system has minimal impact on safety or process output, and is maintained in a steady-state operating mode (e.g., normal operation, standby) with few changes in component status, then it may not be necessary to perform complete or frequent alignment checks. However, if a system is critical to safety or process output, or is constantly undergoing component status changes (e.g., valve manipulations), then more frequent alignment checks would be appropriate.

Equipment and system alignment should be verified following any maintenance activity, including testing, if the activity could have placed components in a position other than that

required for normal operation. Functional testing prior to startup, and periodic surveillance during operation, may be required for equipment that is subject to technical safety requirements. Techniques for verifying component positions and additional information concerning verification requirements are contained in DOE Order 5480.19, Chapter X, "Independent Verification."

When alignment checklists have been completed, they should be signed and approved by the operations supervisor. Completed checklists serve as documentation of the system and equipment status and provide a basis for verification. They should be retained in an accessible location until the next time the checklist is completed, at which time the superseded checklist may be filed.

A system to track deviations from the normal alignment should be established. One method commonly used for this purpose is the status board. Status boards typically contain a graphic or schematic representation of the system, or a listing of system components. When status changes are made, the status board is annotated to indicate the current status of equipment. The status board (or other tracking system) should be promptly updated when a change to system or equipment alignment occurs. In addition, all status changes should be documented in the narrative log. DOE Order 5480.19, Chapter XI, "Logkeeping" provides additional information for maintaining narrative logs.

The status board or other tracking system should be controlled by the operations supervisor and designated system operators. The status control information recorded in the narrative logs and reflected in updates to the tracking system should be incorporated into the operations turnover process. DOE Order 5480.19, Chapter XII, "Operations Turnover," identifies elements of an effective turnover.

4.3 Equipment Locking and Tagging

Locking and tagging, or lockout/tagout, is a program for removing equipment from service and establishing administrative controls to prevent its operation. It is used to ensure the safety of workers performing maintenance or testing, and may be used for other purposes

requiring that the equipment be deenergized and inoperable. Lockout/tagout is applied after equipment has been isolated from energy and hazardous material sources by placing danger tags, or locks and tags, on the isolation devices to ensure that energy cannot be restored.

Because lockout/tagout changes the operational status of the affected equipment, lockout/tagout activities should be approved by the operations supervisor. All personnel should receive training on the requirements of the facility lockout/tagout program and their individual responsibilities under the program. All personnel must understand that operation or manipulation of equipment under lockout/tagout control is strictly forbidden. Additional information concerning lockout/tagout requirements is contained in DOE Order 5480.19, Chapter IX, "Lockouts and Tagouts," and in DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts.*

4.4 Operational Limits Compliance

Those facilities subject to technical safety requirements must establish administrative controls to ensure proper adherence to operational limits (also known as limiting conditions for operation). These operational limits are usually expressed as specific conditions (e.g., a redundant pump is not operable) requiring specific response actions (e.g., load reduction). The operations supervisor should direct, or be aware of, all actions that are taken in response to the operational limit requirements or actions to mitigate adverse consequences to the facility. All appropriate personnel should be informed of the operational limit requirements. All personnel having responsibility for actions under operational limits should periodically review the conditions for operation and ensure that the appropriate actions are performed.

Facilities must document compliance with operational limits. One method is to initiate a tracking document or file each time a designated condition is encountered. The file should include information from logs, alignment checklists, turnover checklists, or other documentation to indicate the initial conditions and circumstances that resulted in restricting operations. All actions taken in response to the operational limit requirements and other

actions to mitigate the consequences to the facility should be documented. When normal operations are again permitted, the tracking document or file can be used to evaluate the event.

4.5 Alarm Status

Reliable, up-to-date information on the status of important processes and systems is essential to the safe and reliable operation of any facility. Much of this information is transmitted to the operator by control panel or local panel meters, gauges, alarms, etc. Checking the status of indicating devices and alarms should be part of each operator's routine inspection tours (rounds). Performance of operator rounds and response to alarm actuation are discussed in greater detail in DOE Order 5480.19, Chapter II, "Shift Routines and Operating Practices."

Alarm systems provide a valuable backup to the operator's monitoring and control of system status. But, just like the systems they monitor, alarms require periodic maintenance and are subject to breakdown. It is therefore important that operators know the status of alarms in their areas of responsibility. Facilities should include within their program for control of equipment and system status, measures to ensure that personnel are aware of the status of alarms. The following specific areas should be addressed:

- Alarms that are totally disabled should be identified to operators through the tagout program, if applicable, or through the use of deficiency stickers, color coding of alarm windows, or other positive means of identification. Instructions for operating personnel should be provided to ensure that equipment parameters are more closely monitored by operators during the period when alarm indication is not available.

- Alarms with individual inputs disabled should be identified to operators and documentation should be available reflecting the changed alarm characteristics. Additional monitoring of equipment parameters is needed for those items that are not capable of actuating the alarm. For example, a particular alarm is designed to receive

inputs for system pressure and temperature, and actuate if either is out of specification. If the temperature input to the alarm is disabled, the operator must monitor the system temperature more closely to compensate for the lack of alarm capability.

- Alarms with temporarily changed setpoints should be documented for operator reference, and may be further identified by color coded alarm windows or other positive means.

- Alarms that are lighted during normal operation should be identified by color coded alarm windows, distinctive labeling, or other positive means.

- Alarms that may be activated by more than one input, but that do not reflash when subsequent inputs are received, should be identified within the alarm response procedures and operator training. Operator training and operations procedures should specify when operators should perform additional equipment parameter monitoring to ensure that abnormal conditions are not masked by alarms that do not reflash.

- Procedures for response to alarm actuation should be controlled and updated to reflect any changes in alarm status. Changes in the alarm status should be transmitted to all activities that may be affected, e.g., training, systems engineering, temporary modification interfaces, etc..

4.6 Equipment Deficiency Identification and Documentation

When equipment deficiencies are discovered, the supervisor should be notified. Then, two distinct actions should be taken. First, the deficiency should be documented and identified for correction in accordance with the facility's work control system. Guidelines and information related to work control systems are contained in DOE Order 4330.4B, *Maintenance Management Program.*

Second, the deficiency should be communicated to other affected personnel. One method is through the use of a deficiency tag. A deficiency tag may be attached to the affected component by operating personnel or others to indicate that a component deficiency has been recognized, documented, and reported in accordance with facility procedures. When the deficiency has been corrected, maintenance personnel should remove the tag. Other methods for communicating deficiencies to affected personnel include caution tags, narrative logs, turnover checklists, round sheets, annotated status boards, etc. Facility policies should specify the method(s) to be used to inform personnel of deficiencies in the equipment they operate and monitor.

4.7 Work Authorization and Documentation

All activities that change the status of systems or equipment important to safety, that affect operations, or that change control indications or alarms, should be authorized by the operations supervisor. These activities may include maintenance, testing, fuel movement, radiography, and others. The authorization should be documented in the work control package.

Organizations and individuals performing work should provide status reports on the work in progress to the operations supervisor. The facility should have a system in place to ensure that status information is provided to the operations supervisor when work is performed by outside personnel (e.g., vendors). The operations supervisor should make these status reports available to all applicable personnel. This permits coordination of interrelated activities among work groups.

4.8 Equipment Post-Maintenance Testing and Return to Service

Before returning equipment to service following maintenance, the equipment should be tested to demonstrate that it is capable of performing its intended function. Two purposes are served by this: the testing should verify that the maintenance was performed correctly

[i.e., it corrected the original problem(s)]; it should also prove that no problems were introduced as a result of the maintenance activities.

The maintenance work control package or maintenance procedure should specify the type and duration of post-maintenance testing required. For some facilities, the specific requirements to prove operability of safety-related systems are identified in Technical Safety Requirements (e.g., Technical Specifications, Operational Safety Requirements, etc.). An engineering evaluation should determine whether additional testing or different methods are required whenever the scope of work is changed, e.g., when additional work is performed to correct a previously undisclosed problem that is discovered during maintenance. All equipment functions that may have been affected by the maintenance should be tested.

Operation of the equipment for testing should be performed by qualified operations personnel in accordance with approved procedures. Maintenance personnel should monitor the testing. The operations supervisor is ultimately responsible for ensuring that the testing proves the operability of the equipment.

4.9 Temporary Modification Control

Facilities should establish administrative control systems for approving, installing, and monitoring temporary modifications. Temporary modifications may include electrical jumpers, lifted leads, pulled circuit boards, disabled annunciators or alarms, mechanical jumpers or bypasses, temporary setpoint changes, installed or removed blank flanges, disabled relief or safety valves, installed or removed filters or strainers, plugged floor drains, and temporary pipe supports.

Prior to installing the temporary modification, the administrative control system should provide for the following activities:

- Communicate the proposed modification to the design authority to allow for evaluation of the modification's impact on current design activities and system characteristics,

approval of the design modification by the design authority, and technical oversight of the installation.

- Perform and document appropriate safety reviews, and obtain all necessary concurrences for approval of the modification.

- Update operating procedures, drawings, and documents as required, and conduct briefings and any necessary training.

The administrative control system should provide for independent verification of correct installation. Additional information pertaining to independent verification can be found in DOE Order 5480.19, Chapter X, "Independent Verification." Periodic audits should be performed to evaluate the status of all outstanding modifications. Independent verification should be performed upon removal of the modification to ensure that all systems and equipment are returned to their normal configuration.

4.10 Distribution and Control of Equipment and System Documents

It is imperative that personnel have and use up-to-date system and equipment documents (e.g., drawings, procedures). A system must be in place to ensure that the correct documents are available and maintained in a location that is accessible during all hours of operation. The system should ensure that document changes or revisions are promptly communicated to appropriate personnel (e.g., operations personnel, testing and maintenance groups, safety analysis groups, procedure review groups, and quality assurance groups).

One method to inform personnel of changes or revisions is using the programs for required reading and timely orders to operators. Required reading can provide a means for personnel to read updated procedures. Timely orders to operators are used to alert personnel to changes in the procedures, equipment, or priorities for operation. For guidance on these programs, refer to DOE Order 5480.19, Chapter XIV, "Required Reading;" Chapter XV, "Timely Orders to Operators;" and DOE-STD-1033-92, *Guide to Good Practices for Operations and Administration Updates Through Required Reading.*

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SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices.

DOE Order 4330.4B, *Maintenance Management Program.*

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter II, "Shift Routines and Operating Practices."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter IX, "Lockouts and Tagouts."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter X, "Independent Verification."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XI, "Logkeeping."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XII, "Operations Turnover."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XIII, "Operations Aspects of Facility Chemistry and Unique Processes."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XIV, "Required Reading."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XV, "Timely Orders to Operators."

DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts*.

DOE-STD-1033-92, *Guide to Good Practices for Operations and Administration Updates Through Required Reading*.

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DOE-STD-1039-93

CONCLUDING MATERIAL

Review Activities:

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DP

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NS

Preparing Activity:

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December 1998

DOE STANDARD

GUIDE TO GOOD PRACTICES FOR CONTROL OF ON-SHIFT TRAINING

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

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Guide to Good Practices for Control of On-Shift Training

Page/Section	Change
pg. vii / Definitions	The definition "Performance-Based Training" was replaced with "Systematic Approach to Training (SAT)."
pg. 5 / Section 3	The reference to DOE-STD-1012-92 was updated to DOE-HDBK-1206-97.
pg. 7 / Section 4.1.1	The reference to DOE-NE-0102T was updated to DOE-HDBK-1078-94.
pg. 9 / Section 4.2	The reference to DOE-STD-1001-91 was updated to DOE-HDBK-1001-96.
pg. 15 / Section 4.6	This entire section was added.
Supplemental Resources	References to DOE-STD-1012-92, DOE-NE-0102T and DOE-STD-1001-91 were updated to DOE-HDBK-1206-97, DOE-HDBK-1078-94 and DOE-HDBK1001-96, respectively.
Concluding Material	The Preparing Activity was changed from NE-73 to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

KEYWORDS

Control of Trainees
Instructor Qualification
On-Shift Training

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DEFINITIONS

Instructor Internship	The method employed to provide an on-shift instructor candidate with individualized instruction and monitoring prior to assignment as an instructor.
On-the-Job Training	The formal training that is conducted and evaluated in the work environment.
Operations	The business activity of the facility and assigned personnel, e.g., controlling process equipment, producing/assembling components, performing tests, conducting experiments, processing information, etc.
Operations Supervisor	The individual having authority and responsibility for operational control of a facility, process, experiment, or other project.
Operator	A qualified person assigned specific responsibilities related to the operation of facility process systems and equipment.
Systematic Approach to Training (SAT)	A training program that includes the following five elements: (1) Systematic analysis of the jobs to be performed; (2) Learning objectives derived from the analysis which describes performance after training; (3) Training design, development, and implementation based on the learning objectives; (4) Evaluation of trainee mastery of the objectives during training; and (5) Evaluation and revision of the training based on the performance of trained personnel in the job setting.
Qualification Program	The formal training process that is used to fully prepare a trainee for the performance of assigned responsibilities.

Qualification Card (On-shift Training Checklist/Performance Evaluation Checklist/Practical Factor Card)	A document that lists qualification program requirements for a specific work station, which is used to document training and evaluation results on a task-by-task basis. (Qualification cards may also be used to document the evaluation of theoretical, equipment, system, and procedural knowledge.)
Shift	The normal period of work for an individual or group (e.g., 8:00 a.m. to 5:00 p.m.)
Training Manager	The individual having authority and responsibility for all training requirements of a facility.
Work Station	The physical area, equipment, and systems for which a person is assigned responsibility.

GUIDE TO GOOD PRACTICES FOR CONTROL OF ON-SHIFT TRAINING

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Control of On-Shift Training, Chapter V of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.* The practices in this guide should be considered when planning or reviewing on-shift training programs. Contractors may use different methods as long as the intent is in agreement with DOE Order 5480.19.

"Control of On-Shift Training" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for a coordinated on-shift training program to meet the continuous demand for skilled, well-trained personnel to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

Facility operation by personnel under instruction is carefully supervised and controlled to avoid mistakes by unqualified personnel, and training activities are conducted to ensure that the time is used effectively.

Criteria:

1. The on-shift training process adheres to established training programs.

2. Trainees are supervised by on-shift instructors who are currently qualified at the work station.

3. Policies directing the use of trainees in support of operations activities are developed to ensure that trainees are effectively and appropriately used.

4. The operations supervisor, or equivalent, approves training programs that best meet operations needs.

5. On-shift training is appropriately documented.

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3. DISCUSSION

On-shift training provides the mechanism for applying the knowledge and skills learned in the classroom, through self-study, and in the laboratory to operating the facility. On-shift training activities are required to provide the trainee with hands-on experience, because neither an outstanding classroom presentation of fundamentals and facility-specific knowledge nor specific laboratory exercises sufficiently prepares an operator to operate a facility safely and efficiently. Since on-shift training allows unqualified personnel the opportunity to operate the facility, controls must be implemented during the performance of on-shift training to ensure that the facility is operated safely and reliably. These controls should prevent accidental, inadvertent, or incorrect manipulation of components, equipment, or systems by trainees. Both on-shift instructors and trainees must understand the controls that regulate the performance of on-shift training.

On-shift training is commonly conducted using the instructional method of on-the-job training (OJT). This form of training has proven very effective in qualifying trainees. OJT addresses the steps necessary to successfully train an individual in the performance of a task, but does not specifically address the controls of the training process and their relationship to the operation of the facility. For information concerning the OJT process, refer to DOE Guideline DOE-HDBK-1206-98, *Guide to Good Practices for On-the-Job Training* (hereafter referred to as *OJT Guide to Good Practices*). "Control of On-Shift Training" addresses the formal, disciplined controls that are required in the operating environment to ensure that on-shift training is conducted safely and efficiently.

On-shift training includes activities that a trainee performs in the operating environment under supervision, as well as training activities that are performed in the operating environment as part of the operator continuing training program. The primary purpose of on-shift training is to allow personnel to acquire first-hand experience by performing or observing operations, special processes, tests, inspections, and other work activities.

In addition to the necessary administrative controls, qualified instructors are also important to the successful control of on-shift training. Competent instructors ensure quality and consistent training of potential operators without compromising the safety and reliability of facility operations. Trainees receive the best and most consistent training concurrent with meeting the production goals of the facility when the instructors are proficient in performing their assigned operational duties while conducting on-shift training. These instructors are best able to interrupt the training when a compromise to safety is becoming evident.

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4. GOOD PRACTICES

4.1 Administrative Controls for the Conduct of On-Shift Training

The Training Department should specify the requirements for a formal on-shift training process to ensure consistent performance of on-shift training activities. Administrative policies or procedures should be established to govern trainee prerequisites, instructor qualifications, and training program coordination.

Cognizant line managers and supervisors should be involved in determining training program content, establishing performance standards, and implementing the program through proper coordination. Involving managers and supervisors helps provide resources, technical input, and commitment to schedules. This involvement also provides the managers and supervisors with insight to the qualification process and its relation to the work assignment.

4.1.1 Trainee Prerequisites

Prior to beginning the on-shift training process, the trainee should be taught fundamental technical and administrative knowledge. The fundamental technical knowledge should be derived from a task analysis. This analysis ensures that the training is appropriate for the actual job performance. The Training Program Handbook DOE-HDBK-1078-94, *Training Program Handbook: A Systematic Approach to Training*, and DOE Order 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*, contain procedures and information to systematically determine training needs.

The trainee should understand safety practices and procedures, work station responsibilities and authorities, and administrative procedures. The instructor should ensure that the trainee understands basic information affecting attention to detail, attitude toward the job, and awareness of the work station's relationship to plant reliability and safety.

4.1.2 Coordination of Training in the Operating Environment

On-shift training activities should be scheduled based on the operating schedules of the facility. This allows trainees to take full advantage of the facility's schedule, minimizing impact on the facility and maximizing the effectiveness of training. In order to maximize training within the operating schedule, the Training Department and the Operations Department must communicate to integrate their respective schedules. In addition, policies and procedures should assign responsibility to a specific individual for coordinating on-shift training. For the purposes of this

document, the person with this responsibility will be referred to as the training coordinator. For facilities using a rotating shift or multiple-shift crews, this responsibility may be delegated to one training coordinator per shift. Using one person per shift should increase training efficiency because training can be rescheduled as necessary to take advantage of operating situations (e.g., unusual or infrequent activities) that might arise during a shift.

4.1.3 Approval of the Operator Qualification Program

The operator qualification program should be approved by the operations supervisor and the training manager (TM) to ensure that both operational needs and training requirements are satisfied. Changes to the program should be coordinated with the Training Department.

4.2 Instructor Qualification

To ensure that training is effectively performed in the operating environment, on-shift training should be conducted by specially selected, qualified operators. The selection should be based on items such as communication skills, technical knowledge, and the ability to impart trainees with hands-on experience. This may require that the operator has received and successfully completed on-shift instructor training. At a minimum, special instructor techniques should be covered that are designed to prevent misoperation or damage to equipment (e.g., where to place hands to prevent inadvertent breaker, switch, or valve operation). Training Department personnel may conduct on-shift training as long as they remain current in their operator qualifications. The requirements for maintaining operator proficiency should be specified in facility procedures.

Potential instructors should complete an instructor internship prior to conducting training in the operating environment. This allows the candidate to acquire supervised practical training similar to mentoring. An instructor internship is designed to verify and strengthen the instructor candidate's instructional abilities within the operating environment. It also gives a candidate's supervisor the opportunity to monitor and evaluate the candidate's instructional and technical competency in a specific training setting.

A qualified instructor should train the instructor candidate on the facility's on-shift training requirements. To ensure consistency in training, items to be performed should be outlined on a qualification card. When the qualified instructor is satisfied that the instructor candidate has demonstrated adequate instructional skills, the qualified instructor should sign the qualification card and recommend the individual for a final evaluation.

The cognizant supervisor should conduct a final evaluation of the instructor candidate's instructional abilities and competencies during an actual on-shift training session. If the instructor candidate is evaluated as satisfactory, the supervisor should sign the qualification card and ensure that the individual's name is entered in the appropriate documents for tracking qualifications (e.g., qualification matrixes, Training Department records, Personnel Department records). For more information on instructor training, refer to DOE-HDBK-1001-96, *Guide to Good Practices for Training and Qualification of Instructors*.

4.3 Supervision and Control of On-Shift Training

The classroom, self-study, and laboratory training portions of the qualification program should provide a trainee with the knowledge and basic skills to perform tasks at a work station. The on-shift training portion of the qualification program should provide the trainee with actual hands-on operation of the facility while under instruction. Unlike training conducted in a simulator or training facility, on-shift training causes the trainee to impact the status of facility operations. For this reason, the on-shift training must be closely supervised and controlled in a way that prevents the trainee from accidentally operating a component, piece of equipment, or system that might cause danger to personnel, to the environment, or adversely affect the operation of the facility.

4.3.1 Preparation (Pre-Training Brief)

Prior to beginning an on-shift training session, the instructor and the trainee should meet to discuss the upcoming session. This meeting is designed to set the ground rules for the session, discuss the events that will take place, and advise the trainee of the information he or she will be responsible for. This requires that the instructor and the trainee have full knowledge of the scheduled training items.

4.3.1.1 Setting the Ground Rules

Before beginning on-shift training, the trainee should understand what is expected. A standard for control of on-shift training that can be easily understood and followed by the trainee and the instructor should be defined in the administrative policies. This should provide a stable on-shift training environment.

All trainees should understand that they are actually operating the facility when performing a task. Unlike training that is performed in a training center or simulator, an incorrectly operated valve, switch, or control may adversely impact a process, an experiment, or the operation of the facility. Trainees

should have a clear understanding of what it is they are about to do, why they are doing it, and the expected effects their action(s) will have on the equipment, system, or process. If the trainee cannot answer these questions, he/she should get clarification prior to performing the action(s).

The trainee should also be aware of the mobility limitations and should remain in sight of the instructor at all times so that the instructor can maintain control of the trainee during the hands-on situation. A good practice is to have the trainee stay "within arm's distance" of the instructor when the trainee operates equipment. Although it is the responsibility of the instructor to supervise the trainee, it is the trainee's responsibility to be in a position to be supervised.

Trainees should also understand that any official round sheets or narrative logs that they use to record facility parameters or remarks are formal documents. Although it is the instructor's responsibility to ensure that all data or remarks are correctly recorded, it is the trainee's responsibility to correctly and accurately record the information in a legible, precise, and understandable manner.

4.3.1.2 Previewing Scheduled Training

The on-shift training schedule should contain a list of all training that is scheduled for a given period. The training coordinator is responsible for developing the schedule. Discussing the scheduled training prior to its occurrence will help the instructor determine how well the trainee is prepared and may also help the trainee gain an understanding of the relationship between upcoming training activities and the operational schedule. If the scheduled training conflicts with the operational schedule, the training coordinator should be contacted to modify the training schedule.

4.3.1.3 Knowledge Spotcheck

The instructor may use the pre-training briefing to determine if the trainee has the required knowledge and skills to perform the training tasks. If the trainee does not have the required knowledge and skills, the instructor must not let the trainee commence training; however, the trainee may be allowed to observe the tasks to gain more knowledge. Information on the appropriate methods for conducting a knowledge spotcheck can be found in the *OJT Guide to Good Practices*.

4.3.2 Supervising On-Shift Trainees

An on-shift training session allows a trainee to operate portions of the facility from a specific work station. Because each action performed by the trainee actually changes the status of the facility, the trainee must be supervised to prevent an adverse situation from arising. Careful and competent supervision of a trainee will prevent mistakes that could lead to an adverse situation.

4.3.2.1 Placing the Trainee at Ease

Immediately prior to beginning a period of on-shift training, the instructor should try to put the trainee at ease. Although the trainee may have had some prior basic instruction, the trainee may not have had enough experience with this particular type of work. It is advisable to ensure that the trainee is fully briefed on all aspects of operations prior to the start of hands-on performance.

4.3.2.2 Commencing Training

Since an on-shift training session allows a trainee to operate equipment at a particular work station, the trainee should perform a turnover with the instructor and also sign into the narrative log, if applicable. The trainee should annotate in the log that he/she is assuming the duties and responsibilities for the work station under instruction. For details concerning making log entries, refer to DOE Order 5480.19, Chapter XI, "Logkeeping." For details addressing turnovers, refer to DOE Order 5480.19, Chapter XII, "Operations Turnover."

4.3.2.3 Control of Trainees

Instructors must maintain control of trainees assigned to their work stations. They must never allow a trainee to operate equipment without directly supervising them. Prior to allowing a trainee to operate equipment, the instructor should:

- Have the trainee review the procedures and reference documents required for performing the task

- Have the trainee explain the action to be performed, including any cautions and notes

- Have the trainee physically identify the component to be manipulated (e.g., valve, switch)

- Assume a position to observe the trainee's action and to prevent the trainee from incorrectly operating the equipment.

These steps should be followed every time a trainee operates equipment until the trainee has demonstrated proficiency in performing the action. Even after a trainee has shown proficiency for a task, the instructor should not become complacent. The trainee may still not be aware of all problems that could occur. Since the instructor still has the ultimate responsibility for the work station, he/she should remain in a position to intervene.

4.3.2.4 Communications During Training

Since communications are an important aspect of operations, proper communication techniques should be reinforced during on-shift training. The need to pass information to operators or supervisors is an essential part of operations in all facilities. This is especially true if the position requires communicating with other work stations during the normal performance of work station activities. The trainee should perform the proper communications as part of the training. The instructor should monitor all trainee communications and correct the trainee when necessary. Instructors must not allow incorrect information to be transmitted.

All communications should be handled in accordance with the guidelines addressed in DOE Order 5480.19, Chapter IV, "Communications." Specific factors that can help promote successful communication training are:

- Using dual communication devices (walkie-talkies, handsets, phones, etc.)

- Requiring the trainee to say the information to the instructor prior to the actual communication

- Correcting errors in trainee communications immediately.

4.3.2.5 Suspension of Training

Suspension of training is the formal termination of the training session. When this is necessary, the instructor should inform the trainee that training is suspended and that the instructor now has control of the work station.

The trainee should have no doubt that training is terminated and that the trainee is to immediately stop whatever he/she is doing. The use of a clear, mutually understandable phrase, such as "hands off," should be spoken in conjunction with the suspension. When the phrase is used, it should be a clear signal to the trainee that the instructor has taken over the control of the work station.

Training should be immediately suspended in the event of unanticipated or abnormal situations. Since the instructor is responsible for operating the facility, training should also be suspended whenever the instructor believes suspension is necessary to ensure safe and reliable facility operation. The responsibility for assessing all abnormal and accident conditions and taking action remains with the instructor.

During abnormal or emergency conditions, trainees may provide assistance (e.g., make narrative log entries, get tools and procedures) at the discretion of the instructor. The instructor must first decide if the trainee is knowledgeable and skillful enough to assist in responding to the situation.

When a training session is suspended for the remainder of a shift, the trainee should sign out of the narrative log. This signifies the official termination of the training session. In order to achieve some benefit from a suspended training session, the instructor may allow the trainee to remain at the work station to observe the instructor perform the assigned task(s). The trainee must remain in a position to observe without obstructing the instructor. An exception to this practice would be if training was suspended for an abnormal or emergency condition, and the condition required evacuation of all unnecessary personnel. In this case, the trainee must evacuate from the premises.

4.3.2.6 Maximum Number of Trainees

Normally, on-shift training, when performing OJT, should be conducted one-on-one. Because of operational commitments or task performance frequency, it may become necessary to simultaneously train more than one person on a task. In these cases, the maximum number of trainees allowed to participate in a training evolution needs to be determined. In making this determination, consideration should be given to precluding the potential for adverse effects on the facility. This determination should also reflect the concern for ensuring effective, high-quality training. Supervisors should ensure that established limits for number of trainees are observed.

In addition, operators should consider the maximum number of trainees (i.e., trainees not performing OJT) that they can adequately supervise at their work station. Even if the trainees are only observing a task or studying components and systems at the work station, they should be supervised or at least instructed of their responsibilities while at the work station. Although there might not be prescribed limits for this situation, operators should limit the number of trainees so that they can continue to operate safely and efficiently.

4.3.3 Concluding On-Shift Training

The instructor should formally conclude the on-shift training session by informing the trainee that the training session is concluded. To enhance training effectiveness, the instructor should receive a turnover from the trainee. For information on turnovers, refer to DOE Order 5480.19, Chapter XII, "Operations Turnover." The instructor should then evaluate the training session in a manner so as to not interfere with his/her ability to continue operating. For information on performing evaluations, refer to the *OJT Guide to Good Practices*.

4.4 Training Documentation

On-shift training documentation should be consistent with Training Department requirements and should be formally documented. The use of qualification cards has proven effective for documenting training. The documentation requirements, including who, how, and when to document training, should be clearly defined and understood by the instructors and the trainees. For additional information on training documentation refer to the *OJT Guide to Good Practices*.

In addition to documenting training in the qualification card, training events should be annotated in the work station narrative log, if applicable. Since narrative logs contain a chronological list of all operational activities that occurred during a specific shift and since most training events are operational activities, the majority of events should already be recorded. Using the narrative log to record events performed during a training session will make it easier to document all training that occurred during a session.

4.5 Using Trainees to Support Operations

Facility policies should address how trainees may be used to support operations. Trainee time should be effectively and appropriately used to ensure a timely completion of training activities. They may be used to support operations but should not be used to perform tasks that they are not qualified to perform. An

example of effective use of trainees would be qualifying a trainee on a task to support the operating schedule, such as fire watch, and then relieving the trainee as soon as possible to allow the trainee to continue with the training process. Prior to assigning trainees to assist in nontask-related activities (e.g., collecting logs, reviewing procedures, and other administrative jobs), supervisors should verify that the trainee has time to perform the assignment and that the assignment will not conflict with the trainee's training schedule.

4.6 Operations Management Involvement in Training

Operations line managers should be personally involved in identifying training needs and verifying that initial and continuing training programs meet these needs. Operations managers approve and periodically review the effectiveness of operations training programs. This includes observing personnel performance, both on shift and during simulator training sessions, and providing feedback to the training department to initiate training program improvements.

Performance standards established by operations managers should be presented, discussed, and reinforced during initial and continuing training. Operations managers should instill a sense of ownership with each shift manager for the training of his or her crew. Shift managers should help identify crew weaknesses and work with operations and training managers to provide training that will strengthen overall crew performance.

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SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter IV, "Communications."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter V, "Control of On-Shift-Training."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XI, "Logkeeping."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XII, "Operations Turnover."

DOE Order 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*.

DOE-HDBK-1078-94, *Training Program Handbook: A Systematic Approach to Training.*

DOE-HDBK-1001-96, *Guide to Good Practices for Training and Qualification of Instructors*.

DOE-HDBK-1206-98, *Guide to Good Practices for On-the-Job Training*.

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DOE STANDARD

GUIDE TO GOOD PRACTICES FOR SHIFT ROUTINES AND OPERATING PRACTICES

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

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Guide to Good Practices for Shift Routines and Operating Practices

Page / Section	Change
pg. 1 / Introduction	The third paragraph was added.
pg. 9 / Section 4.1.3 / eighth paragraph	The reference to DOE Order 4330.4A, *Maintenance Management Program*, was updated to DOE Order 4330.4B with the same title.
pg. 17 / Supplemental References	The reference to DOE Order 4330.4A, *Maintenance Management Program*, was updated to DOE Order 4330.4B with the same title.
pg. C-1 / Appendix C	The appendix, *Additional Guidance for Nuclear Power Reactors*, was added.
Concluding Material	The Preparing Activity was changed from NE-73 to EH-31, and the project number was corrected.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*.

KEY WORDS

Narrative Log
Operating Base
Round Sheet

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DEFINITIONS

Log (Narrative Log)	A chronological narrative record of events or functions.
Operating Base (Shift Operating Base)	The area within a work station (e.g., office, desk, workbench) where a person returns to when not performing other duties (e.g., tours, maintenance, testing).
Operator	A qualified person assigned specific responsibilities related to the operation of facility process systems and equipment.
Round Sheet (Round Inspection Sheet, Round/Tour Inspection Sheet)	A type of data-collection sheet used to record key equipment and system parameters (e.g., readings from instruments and gauges) and operating status (whether operating or shutdown for maintenance or repair) during equipment inspection tours (rounds).
Shift	The normal period of work for an individual or group, e.g., 8:00 am to 5:00 pm.
Shift Routine	A course of action that is followed to accomplish all work station duties in a prescribed manner during a normal working period.
Status	The operational condition or state of readiness of equipment or systems (e.g., on-line, standby, unavailable).
Surveillance	A test, calibration, or inspection that ensures the necessary operability and quality of safety-related items required for the safe operation of a facility.
Turnover (Operations Shift Turnover)	The process of formally transferring duties and responsibilities from one person to another.
Work Station	The physical area, equipment, and systems for which a person is assigned responsibility.

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GUIDE TO GOOD PRACTICES FOR SHIFT ROUTINES AND OPERATING PRACTICES

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, "Shift Routines and Operating Practices," Chapter II of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The practices in this guide should be considered when planning or reviewing shift routines and operating practices. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Shift Routines and Operating Practices" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for a high standard of professional conduct and sound operating practices to promote safe and efficient operations.

Recently, guidance pertaining to this element has been strengthened for nuclear power reactors. This additional guidance is given in Appendix "C" for information purposes. Though this guidance and good practices pertain to nuclear power reactors, DOE sites may choose to use a graded approach for implementing these in nuclear facilities.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

Standards for professional conduct of personnel are established and followed so that personnel performance coincides with the expectations of DOE and facility management.

Criteria:

1. Supervisors and other appropriate personnel are notified of changes in facility status.

2. Personnel follow the facility's industrial safety program.

3. Personnel determine equipment status and area conditions during inspection tours.

4. Round sheets are used to record facility parameters during inspection tours.

5. Personnel maintain exposure to hazards as low as reasonably achievable.

6. Personnel follow specific facility guidance and procedures when responding to abnormal instrument readings.

7. Protective devices are reset using specific facility guidance and procedures.

8. All power or process rate changes are approved by the cognizant supervisor.

9. Personnel have proper authorization before operating any equipment.

10. Personnel use an operating base to perform administrative duties and turnovers.

11. Personnel read only authorized material.

12. Personnel use only devices that relate to the operation of the facility.

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3. DISCUSSION

"Shift Routines and Operating Practices" addresses the professional conduct and good work station practices that result in appropriate attention to facility conditions. It discusses the authority to operate equipment and the status control that is essential to controlling and coordinating facility activities. Emphasis is also placed on effective equipment monitoring and data recording, including notifying supervisors promptly of unusual or unexpected situations. This notification process ensures proper attention is given to changing and off-normal conditions. Industrial safety practices, including radiological and hazardous material protection, are also addressed.

Industrial, military, and commercial utility operating experience has shown that professional conduct and sound operating practices result in a safer, more efficiently run facility. Two key principles to professional conduct and sound operating practices are formality and ownership. Formality is performing all duties according to approved practices and procedures. It ensures a more alert work force and business-like atmosphere. Ownership is an attitude whereby individuals accept total responsibility for maintaining their assigned work station in the best possible operating condition.

The responsibility for safely operating a DOE facility rests with the on-shift personnel. Safe operation is accomplished through adherence to procedures, technical safety requirements (formerly technical specifications or operational safety requirements), and sound operating practices. The authority and responsibility for facility operations should be vested in the cognizant supervisor or manager and be transferred only through formal turnover to a qualified relief.

Establishing clear lines of authority and responsibility for controlling facility operations, including equipment and systems, will enhance facility operations. The authority for operating certain equipment and systems may be given to specific work stations, however the supervisor maintaining ultimate responsibility for the equipment must be notified prior to changes in status. During emergencies, operators should be authorized to take the necessary actions to place the facility in a safe operating or shutdown condition. In this case, the change in status would be reported to the supervisor after the fact.

During special tests, evolutions, or abnormal conditions, personnel should be aware that the responsibility and authority to decide corresponding operating conditions, system alignments, or equipment manipulations rests fully with the on-duty supervisor. This supervisor should not permit any individual to bypass or overrule his/her operational judgment without bringing the matter to the attention of a higher operational authority.

An effective equipment and area monitoring program will help ensure that abnormal conditions and adverse trends are detected in a timely manner. The program should address the equipment and areas to be monitored and the monitoring frequency. This monitoring or inspecting can be accomplished through operator inspection tours (inspection tours). A list of areas and associated equipment under an operator's control should be used to assist personnel in performing inspection tours.

Round inspection sheets (round sheets) can also be used to record equipment parameters during inspection tours. Recording these parameters will assist personnel in detecting trends and serve as

a historical record of facility operations. Trending is necessary to detect abnormal conditions or adverse trends so appropriate action can be taken before equipment malfunction occurs. Establishing procedures which specify when to take readings; how to record readings, how to identify out-of specification readings, how to make corrections on the round sheets; and what actions to take for out of specification readings will improve the accuracy, completeness, and neatness of round sheets. Procedures should also specify a program for developing and maintaining round inspection sheets. Training on these procedures will ensure the proper round sheet information is communicated to all affected personnel.

Sound operating practices also include a strong emphasis on personnel safety practices required to perform a job. Following personnel safety practices should keep personnel alert to detect, prevent, and mitigate all possible hazards. The correct safety practices should be demonstrated to personnel during their initial training and during refresher training (e.g., on a yearly basis), and reinforced continuously, by all personnel, while on the job. Safe work station practices also include maintaining exposure to personnel hazards (e.g., radiation, toxic materials) as low as reasonably achievable (ALARA).

Additional operating practices information for control areas are delineated in DOE Order 5480.19, Chapter III, “Control Area Activities.”

4. GOOD PRACTICES

4.1 Status Awareness and Operating Practices

The primary function of an operator is to monitor and control all assigned equipment safely within the applicable facility guidelines. DOE Order 5480.19, Chapter VIII, "Control of Equipment and System Status," identifies specific facility programs that are designed to aid in safe reliable operation. In addition to those programs, routine operating practices should ensure that the responsible personnel are continuously aware of the status of assigned equipment, and all operations are properly authorized, performed, and monitored. This section describes the routine practices that lead to effective operation.

4.1.1 Authority to Operate Equipment

The overall operation of the facility should be directed by the operations supervisor or cognizant manager. The operations supervisor should ensure that only trained and qualified personnel operate facility equipment and should determine, with the assistance of with the Training Department, work station training and qualification requirements. Facility work stations and the equipment at each work station should be inventoried to ensure all work stations and equipment are identified. Personnel should then be informed of the equipment they are authorized to operate and under what conditions the equipment can be operated. This should be done during the training and qualification process. Support group and subcontractor personnel should be informed of the facility's policy for operation of equipment. This should be done during a general training session before support or subcontractor personnel start work.

Facility policies should specify the activities that may normally be performed by an operator without requesting permission. Examples of activities include the following:

- Pumping specified sumps
- Adjusting controls (e.g., throttle valves, rheostats, switches) that are necessary for maintaining stable process conditions
- Testing local alarm panel lights and sounds.

Personnel should be instructed that safety to personnel, facility, and environment must be maintained over facility production regardless of the situation.

Non-routine operation of controls should not be performed without specific approval by the cognizant supervisor. However, during emergencies, operators must take the necessary actions to ensure the safety of personnel, facility, and the environment. After placing the process in a stable condition, the appropriate supervisors should be immediately informed.

Personnel should be informed of all activities affecting equipment at their work station. Support personnel and subcontractors should contact the person responsible to obtain written or verbal authorization before commencing work, especially if the work will require changing present work station status. To ensure that facility equipment is properly operated at all times, guidance may be established allowing only facility-qualified personnel to operate equipment, even during testing and maintenance evolutions.

4.1.2 Notification of Status Changes

A notification chain or network should be developed to ensure that status information is communicated to the appropriate personnel. Policies or procedures should be established for the timely notification of status changes. Specifics that should be addressed include who needs to be notified, what information needs to be communicated, and the method of communication (e.g., pagers, phone, face to face). Personnel should notify their supervisor of all changes in work station status, especially abnormal and unexpected situations. Supervisors should, in turn, notify the appropriate facility management.

Any person affecting the condition of a piece of equipment not under his/her responsibility for any reason should notify the responsible person before changing the equipment's status, and again afterwards, to inform that status has changed. This would include starting up or shutting down equipment as well as adjusting controls. In addition, if anyone finds an unsafe personnel, equipment, or facility condition he/she should perform all immediate actions that they are qualified to perform (e.g., use a fire extinguisher, administer CPR, open a breaker, shut a valve) and then immediately contact the responsible person.

4.1.3 Inspection Tours

Periodic work station inspection tours should be performed as part of an operator's shift routine. These tours are in addition to the work station walkdowns performed as part of the turnover process. For additional information on turnovers, refer to DOE Order 5480.19, Chapter XII, Operations Turnovers.

Inspection tours should be frequent and detailed enough to ensure that the status of equipment and condition of the work station is known. Each facility should decide the optimum frequency for conducting inspection tours. The frequency and detail of tours should take into account the safety risk associated with the work station. In addition, input should be received from facility maintenance engineers, equipment vendors, and experienced operators when determining touring frequency.

The minimum touring frequency should be at least once per shift. However, the operations supervisor (or cognizant manager) may designate specific areas to be inspected less frequently because of adverse radiological or equivalent personnel safety conditions, or more frequently if problems have been encountered in the past. In these cases, the operations supervisor should specify an alternate inspection schedule. Facility security concerns should not override personnel safety assessment duties.

Inspection tours in radiation and hazardous material areas should be carefully reviewed, planned, and coordinated with the ALARA program to minimize personnel exposure. Tours need to be made in these areas, but the frequency and duration must strike a balance with personnel exposure. Rounds in these areas should be coordinated with other duties and responsibilities (e.g., system alignments, equipment startup or shutdown) as appropriate to minimize exposure. Other methods of minimizing exposure to radiation or hazardous materials is to install microphones, surveillance cameras, and using binoculars.

Personnel should conduct a thorough tour of their work station at the designated times. A tour should be made early in the shift, before the person attends to other duties, to become familiar with the condition and status of equipment at the work station. During the tour, equipment should be inspected to ensure that it is operating properly or, for standby equipment, that it is fully operable. To ensure the tour is effective and efficient, personnel should remain inquisitive; asking themselves questions about their work station and then answering the questions using what they see, hear, smell and touch on the tour.

Personnel should be instructed on proper touring techniques during initial training and qualification. The amount of instruction should depend on the complexity of the work station. Training on how to read parameter-indicating devices (e.g., gauges, meters, chart recorders), how to check equipment temperature (e.g., using the back of the hand for a general indication of the equipment's normal operating temperature), and how to check for system leakage (e.g., using a mirror to check for small steam leaks) should be included, as appropriate. In addition, training should include information on acceptable equipment and system operating parameters (e.g., temperature, pressure, level, flow), including proper trends for all approved operating conditions.

Each facility should establish guidance for handling deficiencies found during inspection tours. At a minimum, abnormal conditions found during tours should be reported to the appropriate supervisor and documented in the narrative log. Each facility should also decide which types of problems can be immediately corrected by personnel before notifying their supervisors and which types should be immediately reported to a control area so that supervisors can initiate corrective action.

Personnel should be encouraged to clean up trash and oil, grease, and water spots discovered during tours to prevent small problems from deteriorating into safety or operational hazards. Problems that might distract personnel from their normal duties should be reported and handled by other appropriate personnel. Equipment deficiencies that cannot be immediately remedied should be documented according to the facility's work control system. Guidelines and information related to work control systems are contained in DOE Order 4330.4B, “Maintenance Management Program.”

4.1.3.1 Area Inspection

Personnel should perform a thorough inspection of their work station and note any deficiencies. Personnel should document and correct deficiencies as

appropriate. Approved supplemental lighting (e.g., flashlight, droplight, portable lighting) should be used to inspect dimly lit work station areas. A checklist may be used to ensure that all items are inspected. A list of some possible inspection items is contained in Appendix A.

4.1.3.2 Equipment Status Checks

The status of equipment (i.e., operating, standby, work-in-progress, or out-of-service) should be determined to ensure proper response to any problems that may arise. Some possible status checks are as follows:

- Operating Equipment
  - Motor and pump housing temperatures are within acceptable limits
  - System temperatures, pressures, and flows are within acceptable limits
  - Proper belt and coupling tightness
  - System leakage is within acceptable limits
  - Noise and vibration is within acceptable limits
  - Ventilation system intakes clear of debris
  - Equipment grounding straps connected
  - Power consumption (Amps, Fuel Oil)
- Standby Equipment
  - Proper valve/circuit breaker lineup (spot check)
  - Oil levels are within acceptable limits
  - No unusual noises, smells, temperatures, or pressures
- Out-of-Service Equipment
  - Boundary components in correct position (spot check).

4.1.4 Round/Tour Inspection Sheets

Round/tour inspection sheets (round sheets) are an effective method for providing personnel with guidance on the extent to which equipment and areas should be inspected during tours. Recording equipment parameters during tours provides a record of equipment performance and can be used to reconstruct events leading up to unusual occurrences or system malfunctions. This record permits short-term trending by personnel so that undesirable trends and equipment problems can be identified and corrected in a timely manner. Round sheets also facilitate the turnover of equipment status and are an effective aid in the training and qualification of new personnel.

Round sheets should be comprehensive; that is, they should include all areas within the purview of a particular work station and all important parameters for equipment. Round sheets should also assist personnel in identifying abnormal and emergency situations. Where appropriate, equipment parameters should include minimum and maximum values or expected operating ranges (i.e., normal range or band of acceptable values) to enable personnel to recognize abnormal readings quickly. When equipment is not in an operating condition (e.g., standby, shutdown for maintenance), the associated parameter block(s) should reflect the status of the equipment. This may be accomplished by the use of codes or notes and annotation in the remarks section. Safety limits derived from Technical Safety Requirements should be highlighted.

A program should ensure that all round sheets are currently and correctly maintained. Rounds sheets should be developed and approved by the appropriate supervisor or cognizant manager, obtaining input from cognizant experts (e.g., vendors, facility maintenance engineers), as appropriate. Work station personnel and appropriate supervisors should supply the input for the sequence in which the parameters appear on round sheets to ensure that tours are conducted efficiently. Equipment and corresponding parameters should be listed on round sheets in a logical order that closely parallels the order encountered during a normal tour. Responsibility for maintaining round sheets should be designated by management. If changes to equipment and systems will require modifications to the round sheet data, the sheets should be updated to accommodate the new data before the affected system or equipment is returned to operation. Changes to round sheets should also be communicated to the appropriate work station personnel. If round sheets change frequently, they should have an approval-for-use signature, revision number, and effective date, as appropriate (refer to Appendix B).

Round sheets may be developed for temporary systems and equipment, depending on the risk to facility operation, proposed length of use, and complexity of configuration. In such cases, the review and approval process stated above should be followed. Personnel should be instructed on the new round sheets before they use them.

A master copy of each round sheet should be kept for updating and restocking the sheet as needed. The program for maintaining round sheets should incorporate a means for verifying that the sheets being used are current and correct. As round sheets are revised, outdated

ones should be discarded. Blank round sheets should be kept in a place accessible to personnel (e.g., control area file cabinet, supervisor's desk, operating base file cabinet). During the revision process it may be necessary to use round sheets with pen and ink changes until the master copy can be updated and revised round sheets distributed. Policies and procedures should address how this situation is handled and personnel should be instructed on their use.

Each round sheet should have enough room to record 24 hours of data or at least a normal shift's worth of data. If more than one data sheet is needed to record all work station data, the rounds sheets should be numbered. The space for recording data should be large enough to allow the full range of values to be recorded legibly. In addition to a place for recording data, round sheets should have the applicable work station printed on the sheet to prevent confusion. There should also be a space for recording the date and the time(s) the rounds were conducted. This information will help when round sheets are reviewed or used to reconstruct events in a chronological order.

Round sheets may include a narrative section if a separate work station narrative log does not exist. Personnel should use the narrative section to document major evolutions, causes of abnormal conditions, and actions taken to correct abnormal conditions. For more information of maintaining the narrative log, refer to DOE Order 5480.19, Chapter XI, “Logkeeping.”

Facility administrative policies and procedures should address the method for identifying out-of-specification parameters. Parameters exceeding the specified maximum or minimum values should be circled in red or otherwise highlighted on the round sheet. If a recorded parameter exceeds the highest or lowest acceptable value, or exceeds a minimum or maximum value, the cause(s) of the abnormal indication should be promptly investigated and reported to the appropriate supervisor, manager, or control area. Supervisors should be kept aware of the situation and should become involved as appropriate for timely corrective action. The cause and status of the abnormal parameters should be explained in the round sheet's narrative section.

Data should be recorded on round sheets at the times specified. When round sheet data is not obtained within one hour of the specified time, the actual time the data was obtained should be noted on the round sheet. The reason for the recording delay should be annotated in the narrative section of the round sheet and reported to the appropriate supervisor.

The recorded data should be legible and should be recorded with an ink pen dark enough to be copied. If a mistake is made on the rounds sheet, the mistake should be corrected. Facility policies and procedures should provide guidance for making round sheet corrections. One method for correcting a mistake is to make a single line through the mistake, initial the lineout, and write the correct data in the same block as the mistake. Since it is impossible to predict when a person will make a mistake, personnel should use only part of the block to record data. This will allow the person to make neat corrections

within the same block. Correction fluid and other opaque agents should not be used to make corrections.

Personnel should be knowledgeable of equipment parameters. They should know where to find the parameter indicating devices (e.g., pressure gauge, thermometer, voltage meter), the scale of the indicating devices, and their normal values. Personnel should understand the significance of each value recorded on the round sheet, whether recorded by him/her or by a previous person. This is particularly true of out-of-specification readings.

The round sheet data should be reviewed by a supervisor each shift to help identify trends or abnormal readings and to verify that the data has been properly recorded. This will require the supervisors be at least as knowledgeable of the subordinate work stations as the assigned personnel. Supervisors should periodically monitor assigned personnel performing rounds to ensure that comprehensive tours continue to be conducted.

4.1.5 Response to Indications

Personnel should believe instrument indications (i.e., treat them as accurate) unless proven otherwise. In situations of doubt, personnel must be instructed to place facility, personnel, and environmental safety above facility production. Ignoring an unusual reading because the person believes an instrument is faulty can cause abnormal conditions to go undetected. Personnel should use other indications, if possible, to confirm unusual readings. Redundant indicators, backup indications, or other process parameters (e.g., a flow gauge indicating proper flow is a process parameter validating that a pump is energized, if the pump's “on” light is not illuminated) could be used to verify an unusual reading. Personnel should also be alert for trends or a deviation from expected trends (e.g., cooling water temperatures rising with no increase in heat load, water flow not increasing, as expected, after starting a pump). Prompt action should be taken to investigate the cause of abnormal or unusual indications to allow timely corrective action. When malfunctioning or inaccurate instruments are discovered, they should be appropriately identified to prevent subsequent confusion. Appropriate personnel should be notified to effect repairs.

4.1.6 Load Changes

The appropriate supervisor, control area lead operator, or manager should approve all load, power, or process rate changes. Since this person is accountable for operation of the process, his/her guidance must be used to safely control the process. The following are example cases of load and process rate changes:

- Changing chemical reaction rates for an experiment
- Changing power level of a power generating station (e.g., coal, nuclear, oil)
- Changing output power of an electrical generator

- Changing flow rate on heat exchanging systems
- Changing air flow rate on filtered air systems
- Changing chemical injection rates
- Starting up or shutting down large electrical equipment that would cause electrical power surges and electrical power load changes.

However, personnel could decrease load or rate without approval, if necessary, to respond to an emergency situation in accordance with the facility's emergency procedures.

4.1.7 Resetting Protective Devices

Protective devices are mechanisms (e.g., circuit breakers, fuses, facility protection channels where multichannel logic exists) that protect a piece of equipment, a system, the facility, personnel, and the environment. When an automatic protective action occurs, the cause should be known, understood, and corrected before resetting the protective devices. Resetting will require that the operator understand how the protective device works, including trip setpoint(s), protective device operation, and current trip signal condition (e.g., signal present or signal absent).

Because the consequences of inappropriately resetting protective devices vary considerably, good judgment and specific guidance are necessary when resetting protective devices. Management should provide the appropriate guidance and procedures to deal with resetting protective devices. Management should specify the types of protective devices that can be reset without formal investigation and how many times a device can be reset before investigating the problem. For example, if a protective device is reset and trips for a second time for no apparent reason, the device should not be reset until the cause is known and corrected.

If a protective device causes a facility trip or unplanned forced shutdown, a thorough investigation is required in accordance with DOE Order 5480.19, Chapter VI, “Investigation of Abnormal Events.”

4.2 Safety Practices

4.2.1 Use of Safety Equipment

Personnel should be instructed on the importance of adhering to the facility's industrial safety program. In addition, they should be informed of the potential safety hazards in their work spaces. Proper hearing, eye, head, foot, and respiratory protection should be worn in designated areas to prevent injury. Similarly, ladders or other approved means should be used to access equipment located in the overhead when permanent steps or catwalks are

not available. Personnel should not climb or walk on facility components and insulation that are not designated as walking or stepping areas.

Each facility should have a policy and checklist for working on or around energized equipment. The type and amount of energy should be considered. Because of the seriousness of the consequences, work on or around energized equipment should be performed only in emergency situations. Personnel required to work under these conditions should be trained on the policy and the use of the checklist. Personnel should exercise appropriate precautions when entering or working on or around energized panels or equipment. For example, personnel should ensure that electrical panel closures are securely fastened before making breakers operable to energize equipment. This reduces the potential for personnel injury if a fault causes breaker arcing during operation.

Personnel working on or around high-pressure or high-temperature systems should exercise appropriate precautions. Facilities should have policies for these situations and train personnel who might encounter these situations. Personnel should follow all facility high-pressure system safety rules, especially when working near pressure relief devices. They should wear appropriate clothing to prevent burns when working around high-temperature systems.

4.2.2 Personnel Exposure

Personnel should be trained to follow good personnel protection practices and minimize their exposure to radiation, chemicals, electromagnetic fields, toxic materials, high heat, high noise levels and other personnel hazards. In particular, personnel should observe the following requirements:

- Adhere to all posted requirements and observe proper practices and precautions while in controlled areas.
- Use appropriate monitoring instruments (e.g., dosimeter, freon detector).
- Know their own exposure levels and take appropriate action to minimize additional exposure.
- Know the proper use of radiation work permits and safe work permits.
- Know inhalation limits, where applicable.
- Report protection deficiencies or hazards promptly to the appropriate supervisors. In addition, take appropriate immediate actions to reduce or correct the hazards.
- Inform appropriate protection personnel before performing evolutions or activities that may change personnel hazard conditions in the facility.

- Inform support personnel working within the work station of the personnel hazards present at the work station.

Factors contributing to personnel exposure should be determined and actions taken to maintain exposure below the ALARA goal. Supervisors should periodically review the status of exposure for personnel under their supervision. An individual's current exposure would then be compared to the appropriate limit so a determination can be made if any additional controls are necessary to prevent personnel from exceeding their limits.

4.3 Operating Bases

An operating base should be established and approved by management for each work station. Each operating base should be equipped with office equipment that allows personnel to maintain necessary procedures and references and to conduct administrative duties. Communication equipment should be available at the operating base. The operating bases should be located conveniently within the area of responsibility, with an alternate area designated in the event the normal area cannot be used because of maintenance or construction. Management should account for the noise level, and radiation and hazardous material conditions before approving an area since turnovers and other duties will be performed here.

4.4 Potentially Distractive Written Material and Devices

Written material that does not relate to work station duties and entertainment devices (such as radios, televisions, tape players, and computer games) should be prohibited at the work station to eliminate distractions. However, personnel may read training bulletins, technical manuals, or review materials that relate to work station duties. Judgment should be used to ensure work station duties are not compromised. Management should provide specific guidance to preclude the use of potentially distractive materials and devices.

Other written material, such as unapproved copies of procedures or other forms of operating instructions, directions, and information, should be controlled to prevent them from becoming distractive. The use of an operator aid posting system has proven effective in controlling information in the operating environment. For more information on the control of operator aids, refer to Chapter XVII, "Operator Aid Postings." In addition, administrative information (e.g., pay period schedules, safety notices) should be posted in designated areas to prevent these documents from becoming distractive.

SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 4330.4B, *Maintenance Management Program*.

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter III, "Control Area Activities."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter VI, "Investigation of Abnormal Events."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter VIII, "Control of Equipment and System Status."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XI, "Logkeeping."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XII, "Operations Turnover."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XVII, "Operator Aid Postings."

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APPENDIX A
SAMPLE LIST OF INSPECTION ITEMS

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SAMPLE LIST OF INSPECTION ITEMS

General Area

- Satisfactory area cleanliness
- Vent and drain caps installed
- Electrical box covers installed and tight
- All hoses and cords properly stored or installed
- Equipment/component labels installed and readable
- Insulation installed and undamaged
- Noise and vibration levels normal
- Equipment access satisfactory and unhampered by scaffolding or other material
- Minimum steam, oil, and water leakage
- Building integrity (physical integrity of structures)
- Safety tags properly completed, adequately attached, and authorized (spot check)
- Maintenance tags applicable and accurate (spot check)
- Fire barriers intact, and no fire hazards present
- Radiation/contamination areas clearly identified
- Hazardous material storage areas clearly identified
- Floor drains open and accessible
- Facility lighting adequate and operative.

Instrumentation and Control Panels

- Power supply available
- Alarms not in alarmed condition
- Recorders operating properly
- Indications within normal ranges (bands)
- Status lights operable
- Alarms operable

Motor Control Centers (MCCs)

- Breakers properly aligned
- Breaker enclosure temperatures normal and no unusual smells
- Breaker position indicating lights operating properly
- Charging springs charged and control power available
- Breaker trips reset

Transformers

- Liquid levels normal
- Temperatures and pressures normal

Wires and Cables

- Disconnected wires and jumpers properly identified
- Hold-down straps secure
- Grounding devices intact

Doors and Gates

- Fire doors closed and not blocked
- Other doors closed and locked as required
- Doors and gates close properly

Sumps

- Liquid levels in normal range
- Sump pumps operating as required
- No oil or organics in sumps

Pumps

- Suction and discharge valves properly aligned
- Suction and discharge pressures in normal range
- Gland seal leakage in normal range

Safety Hazards

- Ladders/gas bottles properly positioned or stored
- Use of proper equipment, such as non-sparking tools, aluminum ladders, etc.
- No water or steam leakage
- No water, oil, or other possible hazards on walking surfaces
- No open panels with potential electrical hazards
- Scaffolds properly erected
- General compliance with facility's industrial safety program requirements
- Open trenches or work areas roped off and posted
- Machine guards and shrouds properly installed.

APPENDIX B
SAMPLE ROUND SHEET

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AUXILIARY BUILDING OPERATOR ROUND SHEET

REV. 002

Page No. 1 of ____

Date:_____

	FUEL OIL STORAGE TANK 1A (INCHES)	LUBE OIL STORAGE TANK 1A (INCHES)	WASTE OIL STORAGE TANK 1A (INCHES)	POTABLE WATER STORAGE TANK 1A (INCHES)	DC CONTROL POWER VOLTAGE (VDC)	AC CONTROL POWER VOLTAGE (VAC)	BATTERY VOLTAGE (VDC)	LUBE OIL PUMP DISCHARGE PRESSURE (PSIG)	LUBE OIL RETURN TEMPERATURE (°F)	FUEL OIL PUMP DISCHARGE PRESSURE (PSIG)	FLOOR SUMP LEVEL (INCHES)	COOLING WATER SUPPLY TEMPERATURE (°F)	COOLING WATER PUMP DISCHARGE PRESSURE (PSIG)	MAIN ROOM AIR FLOW (SCFH)	AUXILIARY ROOM AIR FLOW (SCFH)	MAIN ROOM AMBIENT TEMPERATURE (°F)
MAXIMUM	60	38	25	50	28	130	28	40	180	75	24			30	30	95
HIGH NORMAL	54	32			26	125	26	35	150	62		70	25			
LOW NORMAL	20	15			22	115	22	30	110	58		40	20			
MINIMUM	10	8		5	20	110	20	25 [1]	90	55				5	5	50
TIME																
0000																
0200																
0400																
0600																
0800																
1000																
1200																
1400																
1600																
1800																
2000																
2200																

SHIFT STATUS CHECKS

SHIFT	N	D	E
MAIN ROOM EMERGENCY EQUIPMENT CHECK	☐	☐	☐
AUXILIARY ROOM EMERGENCY EQUIPMENT CHECK	☐	☐	☐
FIRE SUPPRESSION SYSTEM CHECK	☐	☐	☐
MAIN ROOM SAFETY CHECK	☐	☐	☐
AUXILIARY ROOM SAFETY CHECK	☐	☐	☐

SHIFT	N	D	E
SUPERVISOR REVIEW	☐	☐	☐

[1] The lube oil pump automatic shutdown occurs at 24 psig.

Remarks _____

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APPENDIX C
ADDITIONAL GUIDANCE FOR NUCLEAR POWER REACTORS

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This Appendix contains noteworthy additional guidance pertaining to shift routines and operating practices at DOE nuclear facilities.

1. Authority to Operate Equipment

The shift manager directs overall operation of the plant. Control room operators and shift managers need to be aware of all activities affecting plant equipment. Some activities that do not affect safety, regulatory requirements, or operating capability may be performed without the control room operator or shift manager being informed. However, the operations manager determines, defines, and documents these activities. The operations manager defines the operator areas of responsibility for each of these activities. Such activities include pumping certain uncontaminated sumps and making routine minor adjustments to systems in manual control. These activities are documented in a log that shift supervisory personnel and control room operators review. During emergencies, operators take immediate actions necessary for personnel and plant safety without having prior approval; however, they promptly inform the appropriate supervisors of these actions. Shift supervisory personnel and shift technical advisors in the control room refrain from manipulating plant equipment.

Clear expectations should be established for the conduct of system operation by groups other than operations. System or component manipulations that can directly affect core reactivity are only performed under the licensed (senior reactor operator or reactor operator) supervision of the operating crew. Station standards and practices for system and component operation by other groups are the same as those of the operations department. Nonoperations personnel who operate important facility systems should be trained to a level commensurate with that provided to operations personnel.

2. Crew Resource Management

Operating crew resources should be periodically reviewed to verify that they sufficiently support crew responsibilities and assigned tasks during normal, abnormal, and emergency plant conditions. Include the following aspects in this review:

- Sufficient staff should be provided to handle expected normal plant evolutions as well as reasonable abnormal occurrences. A minimum of two senior reactor operators (SROs) and two control board operators (reactor operator licensed or above) are needed at all times on each unit to respond to emergencies. One SRO is qualified as a shift manager and provides oversight during emergencies. The other SRO directs the crew's response to the emergency.

- Appropriate controls should be established to minimize distractions in the control room such as excessive overlapping or simultaneous evolutions. The crew should be augmented with additional operating personnel during complex normal or infrequently performed evolutions, such as plant startups, plant shutdowns, or special tests.

- Sufficient supervision should be provided to implement emergency plan requirements until additional resources can be summoned.

- Duties that require control room operators or supervisors to leave the control room to respond to emergency conditions should be limited. For example, assignment of control room operators and supervisors to fire brigade or medical response duties or to communicate with outside agencies is carefully considered against the need for these personnel to be in the control room during possible concurrent plant transients. Difficulties have been encountered when these support functions were assigned to control room personnel; therefore, other appropriately trained personnel are assigned these responsibilities.

- Sufficient nonlicensed operators or additional licensed operators should be provided to perform normal, abnormal, and emergency shutdown activities outside the control room. These operators are not assigned other duties that could interfere with these responsibilities, such as fire brigade or emergency medical response duties.

- To the extent possible, assigned responsibilities in an emergency should be the same as those during normal day-to-day activities.

- The possibility of simultaneous transients on both units should be considered when staffing dual-unit sites.

Clear guidance should be provided to operating crew supervisors for managing crew resources. To monitor and reinforce expectations for crew resource management, crews should be observed and coached during normal plant operations and during simulator training. Simulator casualty training is routinely performed with the minimum staffing levels expected during actual plant casualties.

Shift technical advisor (STA) functions are implemented with a dedicated, qualified individual or with a combined SRO/STA position. In either approach, the STA role is a key team role that fosters monitoring and independently assesses the appropriateness of crew response to casualties.

If a dedicated position is used, the most effective STAs are those who routinely work on shift with a designated crew. This ensures that the STA is fully informed of plant status should an emergency occur. Also, experience has shown a greater degree of teamwork and credibility if the STA is an integral member of the crew. If an on-call STA is used, the STA should participate in sufficient shift activities (such as crew turnovers and plant tours) to maintain awareness of plant status and evolutions in progress. This helps ensure that this individual can be an effective member of the response team upon arrival in the control room.

When a combined position is used, the STA function is normally combined with the senior licensed individual functioning as the shift manager or the work control room supervisor. For the combined STA/shift manager approach, it is essential that the individual maintains a broad perspective of overall plant response. If the combined STA/work control supervisor approach is used, the individual must monitor critical safety parameters to provide an advisory input to the crew. This individual cannot be drawn into other duties or tasks that detract from this monitoring.

4. Crew Teamwork, Operating Practices, and Diagnostic Skills

Teamwork, operating practices, and diagnostic skills are essential for successful completion of the many complex tasks operating crews perform. Operations personnel work as a team to effectively manage stationwide resources such as personnel, information, and time. Good teamwork is strongly dependent on the relationship of the shift manager and other operating crew members to plant management, as well as on the understanding of and attitude toward the standards and expectations set by station management. Teamwork skills include the following:

- communicating, including open communication among team members
- providing leadership
- problem-solving and decision-making
- team-building
- constructively challenging the actions and decisions of other team members
- resolving conflict
- fostering questioning attitudes
- cross-checking and monitoring
- prioritizing work
- avoiding hasty decisions and hurried actions

To successfully operate the plant, the operating crew integrates technical knowledge and skills by systematically applying necessary diagnostics. Operating personnel are thoroughly trained and evaluated on the plant's operational limits and margins, why the limits and margins exist, and how

they are used to achieve safe and reliable plant operation. Operating crews apply knowledge of reactor theory, thermodynamics, fluid dynamics, and instrumentation and controls to operation of the plant.

Operating practices promote event-free performance. Standards are established for practices such as the following:

- procedure adherence
- communications
- self- and peer-verification
- component manipulation
- pre- and post-evolution briefs
- supervisory oversight and direction
- operating parameter monitoring
- response to equipment abnormalities
- on-the-job training
- logkeeping
- shift turnovers

Establishing observable standards for these practices helps operations managers and supervisors reinforce desirable behaviors.

Operating crew teamwork, operating practices, and diagnostic skills should be routinely monitored to reinforce good crew performance and to identify and remedy weak performance. Also, interpersonal relationships should be considered in crew composition.

3. Operator Workarounds

Equipment deficiencies that adversely affect plant operations or cause operators to take compensatory actions should be identified and assessed. Operators rely on plant equipment to operate as designed to properly respond to abnormal and emergency conditions. When equipment does not operate as designed, operators take compensatory actions. Even during normal operations, a large burden can be placed on operators that detracts from their ability to monitor the plant. Often, individual equipment deficiencies do not pose an unreasonable burden on operators; but in the aggregate, multiple deficiencies pose a significant challenge or distract operators during their day-to-day routines.

Equipment deficiencies, particularly those that are long-standing, increase the probability of inappropriate or inadvertent operation of plant systems and may degrade operator ability to

respond to and mitigate plant transients. These deficiencies are repaired expeditiously. Compensatory actions for equipment deficiencies that significantly affect plant operation should be established and thoroughly communicated. These compensatory actions anticipate all operating conditions. The operating crews thoroughly understand the status of all equipment, how it affects overall plant operation, and required compensatory actions.

When assessing equipment deficiencies, the effect that the deficiency has on operator ability to respond to plant transients and emergencies should be included. Also, equipment deficiencies in the aggregate should be reviewed to determine their combined or cumulative affect on the operators during plant transient response. Equipment deficiency effects should be assessed frequently enough to determine how emergent equipment problems affect plant operators. Equipment deficiencies should be prioritized and categorized to support timely resolution.

4. Infrequently Performed Tests or Evolutions

The operations department has a lead role in ensuring that infrequently performed test or evolution briefings are conducted prior to evolutions that may affect plant conditions. Thorough briefings of all personnel involved should be held and possible adverse consequences of the test or evolution addressed, as well as contingency plans for potential problems. Before any test or evolution is conducted that is outside the bounds of normal plant procedures, the operating crew supervisor should verify that the activity has been reviewed and approved. Supervisors should confirm that their crews have written guidance and training to perform activities successfully.

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CONCLUDING MATERIAL

Review Activities:

DOE

DP

EH

EM

ER

NE

NS

Preparing Activity:

DOE-EH-31

Project Number:

MISC-0013

TS

NOT MEASUREMENT SENSITIVE

DOE-STD-1042-93
June 1993
CHANGE NOTICE NO. 1
December 1998

DOE STANDARD

GUIDE TO GOOD PRACTICES FOR CONTROL AREA ACTIVITIES

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

AREA MISC

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Guide to Good Practices for Operations Turnover

Page/Section	Change
Concluding Material	Preparing Activity was changed from NE-73 to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

KEYWORDS

Ancillary Duties
At-the-Controls Area
Control Area

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DEFINITIONS

Ancillary Duties	Those activities that may be performed by an operator that are not directly related to their prime responsibility, such as the operation and monitoring of equipment.
"At-the-Controls" Area	A designated area where special access and controls are necessary. Examples of which may be the space in front and to the immediate sides of a control panel, control station, computer terminal, etc. The area where facility, work station, or experiment controls (e.g., switches, knobs, buttons) are located.
Control Area (Control Room)	The physical area (e.g., room, booth, desk) where the facility or portions of the facility operations are monitored and controlled.
Turnover	The process of formally transferring duties and responsibilities from one person to another.

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GUIDE TO GOOD PRACTICES FOR CONTROL AREA ACTIVITIES

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, "Control Area Activities," Chapter III of Department of Energy (DOE) Order 5480.19, Conduct of Operations Requirements for DOE Facilities. The practices in this guide should be considered for controlling the activities in control areas. Contractors are advised to adopt methods that meet the intent of DOE Order 5480.19.

"Control Area Activities" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for maintaining a formal environment in operational control areas to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

Control area activities are conducted in a manner that achieves safe and reliable facility operation.

Criteria:

a. Control area access is limited to only personnel on official business.

b. Professional behavior is displayed in the control area.

c. Main control panels are properly monitored.

d. Control area equipment is operated only by authorized personnel.

e. Ancillary duties assigned to control area personnel do not interfere with their ability to monitor facility parameters.

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3. DISCUSSION

The control area of a DOE facility is the focal point of safe and efficient facility operations. It is a central operating base and coordination point for important facility activities. A control area may range in size from a desk or computer terminal to a room of instrumentation and control panels. Whatever the size, a professional atmosphere must be maintained so activities performed in the control area remain focused on the operation of the facility. A properly organized and structured control area should enhance safe and efficient operations.

Large facilities may have a central control area for coordinating overall facility operations and several other areas designated as control areas for specific portions of the facility. Similarly, small facilities may have only one designated area that controls operations. The guidance provided in this document can be used to enhance facility operations in either situation.

DOE Order 5480.19, Chapter III, "Control Area Activities," deals only with situational elements specific to the control area. The information contained in this guide should be used in addition to the information contained in DOE Order 5480.19, Chapter II, "Shift Routines and Operating Practices," to ensure that shift routines for control areas are properly addressed.

Control of access is the key to limiting the number of personnel in the control area. By limiting the number of personnel in the control area, the associated noise, confusion, and possible distractions will be minimized. Access must be controlled to maintain a formal, disciplined atmosphere that promotes teamwork and professionalism.

Professional, businesslike behavior by personnel will enhance the quality of control area activities. Although this behavior is the focus in each chapter of the guidelines to DOE Order 5480.19, nowhere is there more of a need for this type of behavior than in the control area. Whether it is in communications, logkeeping, turnover, or any of the other chapters,

these professional practices embody high standards of technical and ethical performance and help build a foundation for safe and reliable facility operation. Professional behavior during normal operations carries over to handling off-normal and emergency situations safely and efficiently. Maintaining a clean, quiet, neat and orderly environment enhances control area professionalism. Also, this type of environment makes it easier to operate and makes a positive statement about the personnel working there.

Monitoring the instrumentation and control panels in the control area provides personnel with current facility operating information and a means of detecting abnormal conditions before they become problem situations. Although some of the parameters displayed in the control area may also be displayed locally, the control area provides a central area for displaying and monitoring these parameters.

Besides providing an area for consolidating remote indications, the control area may have controls for operating facility equipment. These controls could be used to operate remote equipment in areas with high personnel hazards (e.g., radiation areas, toxic environments) or emergency equipment. In either case, unauthorized operation of controls may hinder facility operation, stop facility operation, or create an adverse environmental, safety, or health situation. These situations can be avoided by identifying who has the authority and responsibility to operate control area equipment.

Monitoring and operating the instrumentation and control panels are the primary responsibilities of control area personnel. When ancillary responsibilities are assigned, they compete with the primary responsibilities for the time and attention of control area personnel. Overburdening control area personnel with ancillary responsibilities will distract them from properly monitoring facility parameters. A structured program for assigning ancillary duties will prevent this situation.

4. GOOD PRACTICES

4.1 Control Area Access

Facility policies should state access requirements for control areas. In special cases, which involve security concerns, access may need to be more rigidly enforced through security policies and procedures. Access requirements should include permission to enter, when (i.e., time periods) personnel are allowed to enter, and under what conditions personnel may enter. The policies should also indicate the positions of personnel who have authorization to enter the control area without permission (e.g., Operations Manager, on-duty Shift Supervisor). Personnel should be instructed to adhere to procedures and restrictions for entering a control area. As a reminder to personnel, control area entrances should be posted with the access requirements. Access to control areas that are open (i.e., no walls or partitions) may require additional guidance (e.g., communicating from outside the control area into the area, what constitutes entry into the control area).

Access to the control areas of a facility should be limited to personnel on official business. Access should not be granted when additional personnel would obstruct the ability to monitor or control. Since information transfer in the control area is crucial to safe operations, during periods of turnover, access should be restricted to on-coming control area personnel needed for the turnover. For information concerning turnovers, refer to DOE Order 5480.19, Chapter XII, “Operations Turnover.” This should reduce the distractions from monitoring of the control panels and associated noise generated from additional personnel. During abnormal or emergency operations, entry should be limited to personnel attending to the situation. Reports should be communicated from outside work stations through work station communication equipment instead of attempting to access the control area. Access for non-work-related reasons should be

prohibited. Necessary facility-related technical and administrative business should be conducted at a location that compromises neither control area personnel attentiveness nor the professional atmosphere.

Access to a control area should be controlled by a designated individual, normally the lead control area person (e.g., cognizant manager, cognizant supervisor, lead operator). Permission to enter the control area should be obtained from this individual. Personnel should know who is designated to grant access.

Control areas may contain one or more control panels. These panels should be clearly identified as “at-the-controls” areas. Their boundaries should be understood by all personnel (e.g., colored tape on the floor, chains or bars placed across the area). Facility policy should state who may grant permission to enter the “at-the-controls” areas. Permission should be obtained from this person before entry. A list of personnel who have authorization to enter, based on their job duties and responsibilities (e.g., control panel operators, control area supervisors), should be established so that these persons can access the area without acquiring additional permission. Access for additional persons into “at-the-controls” areas should be restricted to those personnel who need to be in the area (e.g., maintenance personnel, test engineers).

4.2 Professional Behavior

A formal, professional atmosphere is necessary in the control area. Only activities essential to supporting facility operation and activities authorized by management should be conducted in the control area. Control area personnel should direct their full attention to monitoring and controlling their facility operations. Potentially distracting activities (such as radio listening, reading of non-facility-related information, game playing, and horseplay) should be prohibited. Personnel should not linger in the control area; they should exit the control area when their business is complete.
Non-work-related discussions should be minimized.

4.3 Monitoring the Main Control Panels

Control area personnel monitor instrumentation and control panels to ensure that the facility is operating safely. They should be alert and attentive to indications and alarms. Control panel indications should be frequently scanned, with emphasis on trending, to detect problem situations early. Prompt action should be taken to determine the cause of abnormalities and correct the problem situation.

Facilities should develop procedures that dictate alarm response actions. Response to alarms should be timely. Control area personnel should inform the lead control area person of each alarm and take actions to identify and correct its cause(s). All reasonable action should be taken to clear alarming conditions. The abnormal conditions resulting from the alarm should be monitored more frequently until they have returned to normal.

Instrumentation and control panel indications should be monitored with increased frequency during evolutions that affect them. When the indications stabilize, monitoring frequency can return to normal. The number of evolutions affecting instrumentation and control panel indications performed concurrently should be limited so that personnel can detect and respond to abnormal conditions appropriately. If necessary, the lead control area person should stop one or more of the evolutions or assign additional personnel to assist in monitoring. The lead control area person should ensure that monitoring of non-affected indications continues during these situations.

If computer or automated monitoring and control systems are used, they should be monitored for proper operation. In addition, manual response should backup these systems. For example, if a variable exceeds an action setpoint and the action does not occur, personnel should initiate manual action. It must be understood in these cases, control area personnel still have the responsibility to monitor and control facility operation.

4.4 Operation of Control Area Equipment

Duties and responsibilities for control area personnel during normal, abnormal, and emergency situations should be well defined. Administrative policies and procedures should specify the personnel requirements for operation of control area equipment. Operation of control area equipment should be performed only by authorized personnel. Equipment to be controlled and monitored by each control area person should be specified. Control area personnel should receive training on their duties and responsibilities.

A list of personnel authorized to operate control area equipment should be maintained in the control area. Trainees who operate control area equipment should be supervised and controlled by the person who is authorized to operate that equipment. The person supervising should not allow the trainee to perform operations without direct supervision. For more information about supervising trainees, refer to DOE Order 5480.19, Chapter V, "Control of On-shift Training."

4.5 Control Area Ancillary Duties

Ancillary duties of control area personnel should not affect their ability to monitor and operate instrumentation and control panels. Their administrative duties should be minimized. Activities such as preparation of lockouts and tagouts, review of maintenance work activities, assisting maintenance groups, required reading, or housekeeping should be conducted to minimize the effect on their primary duties and responsibilities. Administrative activities not required to be performed within the "at-the-controls" area should be assigned to other personnel.

Facility policies and procedures should address ancillary duties and responsibilities. Within the control area, the lead control area person should have the responsibility for ensuring that ancillary duties do not compromise primary job duties. Ancillary duties should not be performed during off-normal or emergency situations. These situations

should command the complete attention of the control area personnel. Control area personnel should be instructed on the importance of not allowing their ancillary duties to interfere with their primary duties and responsibilities.

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SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 5480.19, Conduct of Operations Requirements for DOE Facilities, Chapter II, "Shift Routines and Operating Practices."

DOE Order 5480.19, Conduct of Operations Requirements for DOE Facilities, Chapter III, "Control Area Activities."

DOE Order 5480.19, Conduct of Operations Requirements for DOE Facilities, Chapter V, "Control of On-Shift Training."

DOE Order 5480.19, Conduct of Operations Requirements for DOE Facilities, Chapter XII, "Operations Turnover."

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CONCLUDING MATERIAL

Review Activities:

DOE

DP

EH

EM

ER

NE

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Preparing Activity:

EH-31

Project Number:

MISC-0017

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NOT MEASUREMENT SENSITIVE

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DOE STANDARD

GUIDE TO GOOD PRACTICES FOR OPERATOR AID POSTINGS

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

AREA MISC

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Guide to Good Practices for Operator Aid Postings

Page / Section	Change
Concluding Material	The Preparing Activity was changed from NE-73 to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*.

KEYWORDS

Operator Aid
Posted Procedure
Posted Information

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DEFINITIONS

Operations	The business activity of the facility and assigned personnel, e.g., controlling process equipment, producing/assembling components, performing tests, conducting experiments, processing information, etc.
Operations Supervisor	The individual having authority and responsibility for operational control of a facility, process, experiment, or other project.
Operator	A qualified person assigned specific responsibilities related to the operation of facility process systems and equipment.
Operator Aids (Operator Aid Postings)	Approved, posted information used to assist personnel in performing a task [e.g., copies of procedures (portion or pages thereof), system drawings, information tags, curves, graphs, prints].

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GUIDE TO GOOD PRACTICES FOR OPERATOR AID POSTINGS

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Operator Aid Postings, Chapter XVII of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The practices in this guide should be considered when planning or reviewing operator aid postings. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Operator Aid Postings" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for controlling posted information to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

An operator aid program is in place to ensure that operator aids are current, correct, and useful.

Criteria:

a. Personnel follow guidelines for developing operator aids.

b. Operator aids are approved prior to being posted.

c. A list of approved operator aids, along with a reference copy of each operator aid, is maintained.

d. Placement of operator aids adequately supports their intended use and does not obscure instrumentation or controls.

e. Operator aids are a convenience to the individual using them.

f. Operator aids are periodically reviewed for currency and relevance.

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3. DISCUSSION

Operator aid postings (operator aids) provide information for personnel to use during the performance of tasks. This information may be in the form of a system drawing, copy of a procedure, information tag or sheet, curve, chart, or graph. Posted copies of procedures or portions of procedures that are used as operator aids may be useful when the performance of a task makes it impractical to refer to a procedure in a manual (e.g., task requires the use of both hands). Operator aids may help the operator identify problems that might be encountered during performance of a task, or they may present a simple diagram of equipment, systems, or areas (e.g., piping diagrams, electrical schematics). Other examples of operator aids include:

- A list of approved facility communication terms, abbreviations, and emergency numbers posted by communication equipment,

- A graph of flow versus pump speed for a variable speed pump hanging beside the pump speed control switch,

- A simple diagram of control knobs, valves, and switches for infrequently used equipment,

- Specifications for a particular step in a task. (For example, pH minimum and maximum values and elemental concentrations for disposing of fluids posted by the drain. This one may be particularly useful since specifications for different fluids can be found in many different manuals.)

Operator aids must reflect the most current information and they must not conflict with any procedures or requirements. Using operator aids containing outdated or incorrect information may cause harm to personnel or damage to the equipment, system, area, or facility. Also, if operator aids are developed for other than normal operations, (e.g., for temporary systems, for abnormal system configurations, for emergency situations) it is a good practice to clearly identify the circumstances under which they apply.

Developing useful operator aids may require intensive research and forethought. The information presented in the operator aid must be factual, and organized in a manner usable for all intended users. A thoroughly developed operator aid will ensure that the approver and reviewers better understand its need and usefulness. During the development process, reviews by applicable technical personnel may be helpful to ensure clarity.

An initial review and approval process verifies that the information contained in an operator aid is accurate and useful. This process officially authorizes its use. Periodic reviews will help ensure that the information is kept up-to-date and will verify the continued usefulness of the operator aid. It is important to remove obsolete, conflicting, or non-useful operator aids as quickly as possible to eliminate personnel confusion when performing tasks.

Documentation of operator aids is essential to their control. Maintaining a centrally located file of all operator aids will enhance the periodic review process. This file will help personnel quickly review and take action to correct, update, or remove obsolete operator aids as necessary. Listing reference documents used in the development process facilitates finding and updating operator aids when reference information changes.

Placing an operator aid in a conspicuous place that will allow the user to access controls or instrumentation is essential to posting. If the operator aid blocks instruments or controls, it will be more of a hinderance than a help. Affixing operator aids to the desired location using an attachment device suitable to the posting surface and the environment will ensure that the operator aid remains posted. An operator aid will be of little use if it comes loose and falls from its desired location.

The operator is one of the most important elements in ensuring the success of the operator aid program. Using only approved and current operator aids will help ensure the operator aid promotes safe and efficient operation. Operators must identify and report unapproved or incorrect operator aids at their work stations. This will ensure that the operator aids remain a useful tool in conducting business safely at their facility.

4. GOOD PRACTICES

This good practice provides instruction on how to administer and control an effective operator aids program, including operator aid development, approval, documentation, posting, use, and review. Each of these six steps are important to ensure that only useful operator aids are posted, and that they remain updated during their use.

Operator aids should be developed to provide the user with information that might otherwise be overlooked. The need for an operator aid should be concurred with prior to expending resources in its development. Operator aids may be developed to supplement procedures, but should not be developed to alter (e.g., correct or update) procedures. Only procedure changes and revisions should be used to alter procedures. For more information on procedures refer to DOE Order 5480.19, Chapter XVI, "Operations Procedures."

Operator aids must not be developed for personnel and equipment safety situations where danger or caution tags should be used. The facility lockout and tagout procedure should address the correct mechanism(s) for protecting personnel and equipment. For information on lockouts and tagouts, refer to DOE Order 5480.19, Chapter IX, "Lockouts and Tagouts."

Operator aids should not be developed for use as equipment and piping labels. Guidance concerning labeling should be provided in the facility's equipment and piping labeling program. For information pertaining to labeling, refer to DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XVIII, "Equipment and Piping Labeling."

4.1 Operator Aid Development

Facility personnel should be encouraged to develop needed operator aids. Therefore, all personnel, including support personnel, should be aware of the operator aid development process. Prior to developing an operator aid, personnel should be trained on the development process. As a minimum, this training should cover the importance of controlling posted information and the procedure or guidelines for developing an operator aid. Information control topics such as why it is important to use only approved operator aids, how to tell if an operator aid is approved, what to do if it is not approved, and how to verify that an operator aid is current should be addressed.

When developing operator aids, personnel should use the most current information. This may require communicating with personnel in the facility's document control organization to ensure that the most current revisions of reference documents (e.g., procedures,

drawings, technical manuals) are being used. To ensure the operator aid is correct, the developer should communicate with other users, competent technical authorities (e.g., system, facility, or safety engineers), and the cognizant supervisor.

An operator aid submitted for approval should contain the reference information that the approver will need to ensure that the operator aid is necessary and correct (e.g., document names, numbers and revision numbers, technical personnel phone numbers). Including this information with the operator aid will minimize the time required for approval. To ensure that the proper information accompanies each operator aid that is submitted, an operator aid approval sheet, which contains spaces for this information, could be used. Appendix A contains a sample operator aid approval sheet.

If operator aids are developed for other than normal operations, they should clearly identify their intended purpose. For example, if an operator aid is developed for a temporary system, it may contain the title "Temporary System Operator Aid" or may be developed using a different color paper. If an operator aid is only to be used for a limited time or in certain situations the operator aid should contain this information also (e.g., "This operator aid for use only during Mode 1 operation."). Including this information should help reduce the human interface problems associated with operator aids.

Operator aids should be prepared in a professional manner (refer to Appendix B). Operator aids submitted for approval should be identical, or as close as possible to the size, format, material and quality of the proposed operator aid. This will allow the approver to see how the operator aid will appear, before it is approved. To assist in preparing the operator aid, facility support personnel (e.g., technical writers, graphic artists) may need to be contacted, especially if the operator aid contains complex figures or drawings.

4.2 Approval

After an operator aid is developed, it must be approved before posting. At a minimum, the operations supervisor or cognizant manager should approve the operator aid. Support organization personnel wanting to have an operator aid posted should submit the proposed information to the operations supervisor for approval.

The person responsible for approving the operator aid (the approver) should verify that it is necessary. This verification will limit the number of operator aids posted in the facility.

If an administrative mechanism (e.g., label, tagout, procedure change) should be used, the operator aid should not be approved.

The next step is to verify that the operator aid is correct. Part of this verification should ensure that the operator aid does not contradict or alter procedures. The documents and technical authorities referenced for the submitted operator aid should be consulted to verify correctness. Using an operator aid approval sheet should enhance this process since all of the information is listed in one convenient location.

If the approver verifies that the operator aid is necessary and correct, the approver should sign and date the operator aid to signify that it is approved. Once approved, the operator aid should be documented and routed for posting. If the operator aid is not approved, it should be returned to the developer with an explanation concerning its disapproval and requirements for resubmittal and final approval.

4.3 Documentation

All approved operator aids should be documented. At a minimum, a listing of all approved operator aids should be maintained, along with a reference copy of each operator aid. The reference copies should be used to replace operator aids found to be damaged or missing. If an operator aid approval sheet is used, it should be kept with the copy of the operator aid. All operator aid documentation should be kept in a specified location (e.g., control area, operation supervisor's office, project manager's office, other appropriate location).

The listing of all approved operator aids, also called an index, serves as a record for all operator aids posted in the facility. This index should contain the operator aid's control number, title, reference documents, posted location, approval signature and date, and removal signature and date. If an operator aid approval sheet, which contains this information, is used, the index would not need to duplicate all of the information. Appendix C contains a sample operator aid index sheet for both cases.

To assist in tracking operator aids, each operator aid should be assigned a unique control number. One method of assigning control numbers is to use a sequential serial number. As an example, operator aid control number 92-02 would indicate the second operator aid issued for the year 1992.

A system, such as a binder, should be used to maintain the operator aid information. This binder may include a copy of the operator aid development procedure or

guidelines, the operator aid index, and a reference copy of all operator aids. If an operator aid approval sheet is used, it should be filed in the binder with its associated operator aid.

4.4 Placement

Approved operator aids should be placed (posted) in proximity to the area of expected use. They should not obscure instruments (e.g., meters, gauges, indicating lights) or interfere with controls.

An operator aid should be firmly attached at the specified location. The attachment method should be compatible with the environment. A form of attachment should be used such that when the operator aid is no longer needed, it can be readily removed.

The posted operator aid should be protected from the environment. If an operator aid is located in an area where it might become wet, oil-stained, or otherwise unusable, it should be laminated, placed in a clear plastic pouch, or made of material that will withstand the environment. Using a paper copy of the operator aid placed in a clear plastic pouch is a suitable, inexpensive method.

4.5 Use of Operator Aids

Operator aids should be viewed as a convenience to the individual using them, not a requirement. Although copies of procedures or portions of procedures can be used as operator aids, the requirement is to follow the procedure. The operator aid makes it easier for the operator to follow the procedure, because the procedure is conveniently posted. The decision to use the posted procedure or the procedure in the manual should be left to the operator.

All personnel should be trained on the need for controlling posted information. This training should cover why it is important to use only approved operator aids, how to tell if an operator aid is approved, what to do if it is not approved, and how to verify that an operator aid is current.

When an operator aid is used, the user should verify that it is approved. If the posted information is not approved, the person should not use it and should notify the supervisor. A decision should be made whether to submit the operator aid for

approval or remove it. If the operator aid is unusable because of wear or dirt, the operator should obtain a new copy of the operator aid. When the need for an operator aid no longer exists, an operator or the developer/organization originating the operator aid should notify the appropriate supervisor and ensure that the operator aid is disposed of in accordance with facility policies and procedures.

4.6 Review of Operator Aids

Posted operator aids should be reviewed periodically to ensure that they are still correct, necessary, and don't supersede or conflict with controlled procedures or information. A person or persons should be assigned the responsibility for auditing the operator aid index to ensure that only currently posted aids are recorded on the index. This person should verify that each operator aid listed in the operator aid index is still posted and necessary. This determination should be made through discussion with the affected operators. If it is still necessary, the auditor should verify the location is the same as that recorded on the operator aid index sheet or the operator aid approval sheet and that each operator aid is legible and in good condition. No unapproved pen-and-ink changes should exist. The auditor should also verify that the information contained in the operator aid is current and applicable. If the operator aid is still needed but is missing, a new copy should be posted. If the operator aid is no longer needed, the reference copy should be removed from the operator aid binder and the operator aid should be deleted from the index (i.e., the removal signature and date block of the index should be completed).

Since operator aids may be copies of graphs, curves, or procedures, the information is subject to change as the reference documents are revised. Therefore, the reference documents should be periodically checked for the latest revision numbers. If a revision to an operator aid's reference document has changed information on the operator aid, the operator aid should be updated. One way to ensure that revisions are incorporated into operator aids is to notify the appropriate document control personnel of those operator aids that are derived from controlled (parent) documents. This would effectively place the appropriate person(s) on the document control system distribution list for the specified parent documents. When a revision is made to one of these controlled documents, document control would notify the appropriate control area of the affected operator aid(s). The appropriate review person would then determine if operator aid changes were necessary.

Besides a formal periodic review of all operator aids, personnel should be instructed to review operator aids at their work stations to ensure they are approved and correct. This may be done during routine work station tours, or as a separate inspection. If unapproved operator aids are found, they should be reviewed and submitted for proper approval, or removed if determined to be unnecessary.

SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter IX, "Lockouts and Tagouts."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XVI, "Operations Procedures."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XVIII, "Equipment and Piping Labeling."

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APPENDIX A
SAMPLE OPERATOR AID APPROVAL/AUDIT SHEET

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OPERATOR AID APPROVAL/AUDIT SHEET

Operator Aid Control No.: _____

Operator Aid Name: _____

_____

Description: _____

_____

Reason for Posting: _____

_____

_____

Posting Location: _____

_____

Reference Documents: _____ Rev. No.:_____

_____ Rev. No.:_____

_____ Rev. No.:_____

Developer: _____ Date: _____

Department: _____

Reviewers: _____

_____

Approval Signature: _____ Date: _____

Audited:

Date	Initial	Date	Initial	Date	Initial	Date	Initial

Notes:

Operator Aid Control No.	The next sequential number for operator aid issuance.
Description	A description of the operator aid (e.g., chart, graph, procedure inset).
Reason for Posting	An explanation of the need for the operator aid.
Posting Location	The desired location for posting the operator aid.
Reference Documents	Any documents that were used to obtain the operator aid information (e.g., procedures, technical manuals, reports, prints, drawings). If the document has a revision, the revision number should be listed.
Developer	The name and position of the person developing/requesting the operator aid.
Department	The department (e.g., Operations, Maintenance) of the developer.
Reviewers	The names and positions of all additional technical personnel involved in the initial development and approval process.
Approval Signature	The approvers signature, position, and date signed signifying the operator aid is necessary and correct, and approved for posting.
Audited	When an operator aid is audited the auditor dates and initials the next open line signifying the operator aid is still necessary and correct.

APPENDIX B
SAMPLE OPERATOR AIDS

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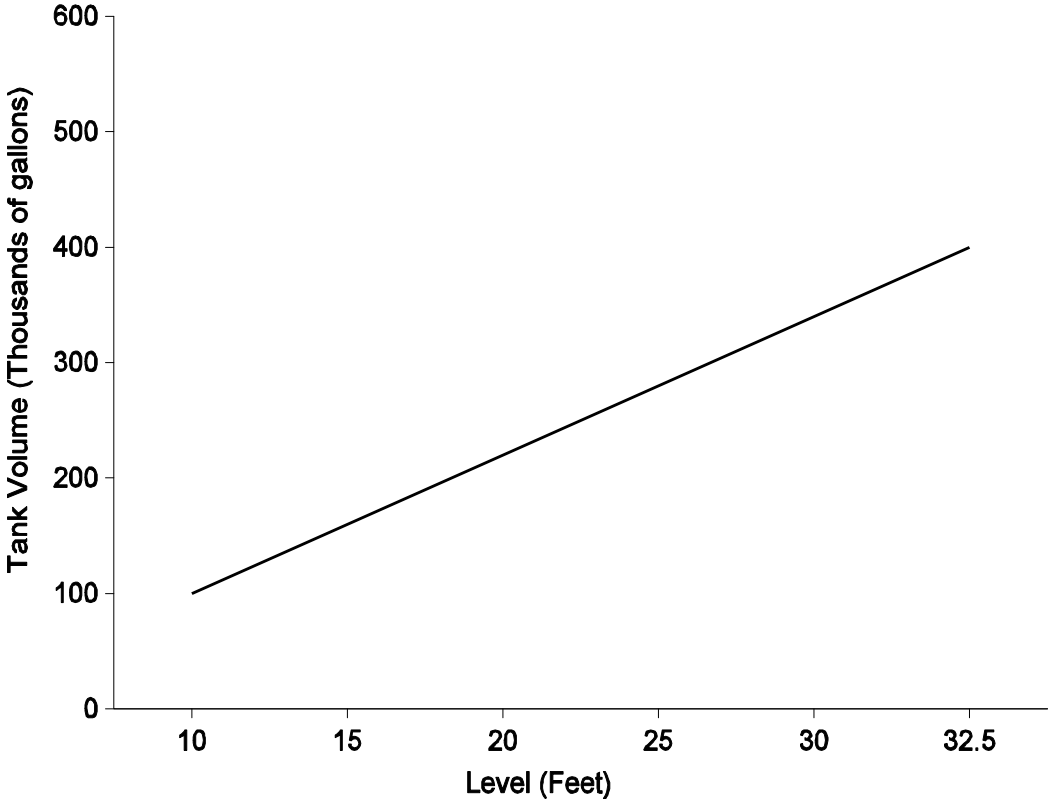
OPERATOR AIDS

CONDENSATE STORAGE TANK VOLUME VERSUS LEVEL



Prepared by: _____ Date: _____

Approved by: _____ Date: _____

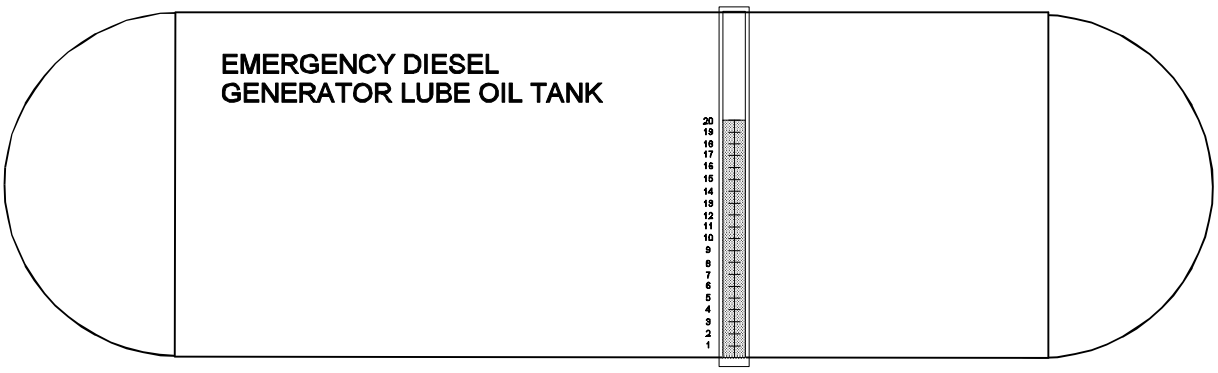
Number: _____

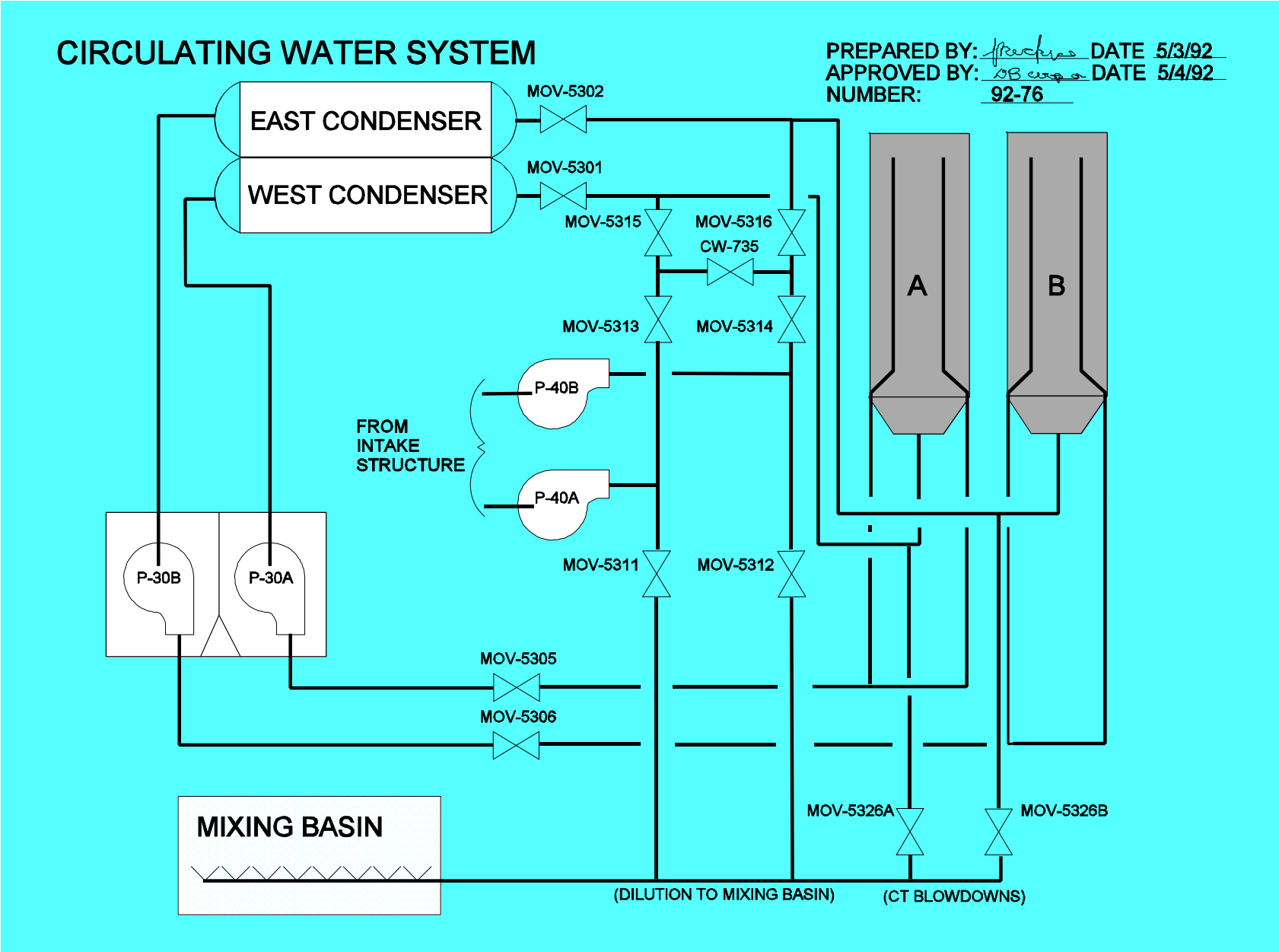
LUBE OIL TANK SIGHTGLASS LEVEL CONVERSION CHART

Since the sightglass on the lube tank to the emergency Diesel Generator is incremented in inches and our fuel oil consumption reports are in gallons, the following chart should be used to convert level in the lube oil tank to gallons.

Prepared by: _____ Date: _____
Approved by: _____ Date: _____
Number: _____

INCHES	GALLONS
20	104.0
19	98.1
18	92.0
17	85.9
16	79.7
15	73.4
14	67.2
13	61.0
12	54.9
11	48.8
10	42.9
9	37.1
8	31.4
7	26.1
6	20.9
5	16.1
4	11.6
3	7.6
2	4.2
1	1.5




CIRCULATING WATER SYSTEM
PREPARED BY: DATE 5/3/92
APPROVED BY: DATE 5/4/92
NUMBER: 92-76
EAST CONDENSER
WEST CONDENSER
MOV-5302
MOV-5301
MOV-5315
MOV-5316
CW-735
MOV-5313
MOV-5314
A
B
P-40B
P-40A
FROM
INTAKE
STRUCTURE
P-30B
P-30A
MOV-5311
MOV-5312
MOV-5305
MOV-5306
MIXING BASIN
MOV-5326A
MOV-5326B
(DILUTION TO MIXING BASIN)
(CT BLOWDOWNS)

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APPENDIX C
SAMPLE OPERATOR AID INDEX SHEETS

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OPERATOR AID INDEX SHEET USED WITHOUT AN OPERATOR AID APPROVAL SHEET

Operator Aid Control Number	Title of Operator Aid	Reference Documents	Posted Location	Approval Signature/Date	Removal Signature/Date

OPERATOR AID INDEX SHEET USED WITH OPERATOR AID APPROVAL SHEET

Operator Aid Control Number	Title of Operator Aid	Approval Signature/Date	Removal Signature/Date

CONCLUDING MATERIAL

Review Activities:

DOE
DP
EH
EM
ER
NE
NS

Preparing Activity:

DOE-EH-31

Project Number:

MISC-0018

TS

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DOE-STD-1044-93
June 1993

CHANGE NOTICE NO. 1
December 1998

DOE STANDARD

GUIDE TO GOOD PRACTICES FOR EQUIPMENT AND PIPING LABELING

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

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Guide to Good Practices for Equipment and Piping Labeling

Page/Section	Change
pg. A-4 / Table A-1/Arrange by System Name column	The following system name and code were deleted: “Waste, Radioactive” and “RW.”
pg. B-4	The first bullet was added.
Concluding Material	The Preparing Activity was changed from NE -73 to EH-31.

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FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

KEYWORDS

Equipment Identification
Label

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GUIDE TO GOOD PRACTICES FOR EQUIPMENT AND PIPING LABELING

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, "Equipment and Piping Labeling," Chapter XVIII of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The practices in this guide should be considered when planning or reviewing labeling programs. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Equipment and Piping Labeling" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for a coordinated labeling program to promote safe and efficient operations.

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2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

An equipment labeling program is established and maintained to ensure that facility personnel are able to positively identify the equipment they operate.

Criteria:

a. Equipment, components, and piping that require labeling are identified by the facility.

b. Label information meets regulatory requirements and is consistent with facility procedures.

c. Label materials and means of attachment are compatible with the components and environment where they are used.

d. Labels are properly placed and oriented to enhance readability and component identification.

e. Checks to verify that labels are correct are included in designated operating procedures.

f. Procedures are established to replace lost or damaged labels and to acquire new labels when needed.

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3. DISCUSSION

A well-established and maintained labeling program is essential for safe, reliable operation and maintenance of DOE facilities. During the period December 1990 through August 1992, DOE facilities reported more than 40 occurrences in which ineffective or incorrect labeling of equipment and piping contributed to errors in implementation of lockout/tagout, maintenance on the wrong equipment, inadvertent equipment startup, failure of designated safety or backup systems, or improper operation of facility equipment. The consequences, or potential consequences, of these occurrences include personnel injury, equipment damage, release of hazardous or toxic material, and loss of proper control of nuclear materials and processes.

An effective labeling program will clearly identify each component required in the operation of the facility, warn of specific hazards, and clearly identify emergency equipment. Effective labeling will enhance training effectiveness and help reduce operator and maintenance errors resulting from incorrect identification of facility equipment. Effective labeling will help reduce personnel exposure to radiation or hazardous materials by reducing the time spent identifying components. Piping labels that identify the contents, or at least the type of hazard represented by the contents, and the normal direction of flow will aid in preventing or mitigating leaks and spills. Labels on electrical equipment identifying the applicable feeder panel or breaker will aid in isolation for lockout/tagout, and will aid in quick and accurate response to equipment emergencies.

Labels should be designed to present information in a manner that will enhance operations and maintenance. The equipment names and number designations used on labels should be consistent with those used in procedures and drawings. Label size, placement, arrangement, fabrication materials, color coding, lettering size and type style can all affect the usability of labels. The Electric Power Research Institute (EPRI) report, EPRI NP-6209, *Effective Plant Labeling and Coding*, contains research data and illustrations showing how to use labels effectively in control room and plant environments.

To remain effective, the labeling program must be an ongoing process. Maintenance activities involving removal or replacement of equipment may also result in loss or misplacement of component labels. Spills, passage of time, or other environmental factors may cause labels to become damaged or unreadable. Equipment modifications may result in new label requirements. Facility procedures should provide instructions for temporarily labeling components, and a central point of contact to ensure timely response to ongoing labeling requirements.

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4. GOOD PRACTICES

4.1 Components Requiring Labeling

Facilities should establish written guidelines for labeling components, systems, and hazards that personnel may be expected to encounter in the course of their work. The following items should be considered for the labeling program:

- Cabinets, including internal components (relays, terminals, etc.)
- Circuit breakers (4.16kV, 480V, 120VAC/DC, etc.)
- Electrical busses
- Electrical distribution and lighting panels
- Emergency equipment (fire alarm stations, eye wash stations, etc.)
- Equipment components (motors, valves, pumps, etc.)
- Equipment subsystems
- Exits, evacuation routes
- Facility location codes (buildings, columns/rows, floors/elevations)
- Floor drains
- Fluid and gas lines (piping, ventilation ducts, etc.)
- Fire protection systems and equipment
- Fuse blocks or fuse locations
- Gauges, meters, and other indicators
- Major equipment systems (e.g., emergency generator, heating and air conditioning system, etc.)
- Motor control centers
- Protective equipment, first aid equipment, safety devices
- Room doors (list major equipment inside hazardous or radiation areas)
- Safety hazards and warnings
- Storage containers, cabinets, storage spaces
- Test equipment, special tools

4.2 Label Information

A label should provide a concise and meaningful verbal description of the function (noun name) of an item being identified, and a unique alphanumeric code identifying the system and component, as shown in Appendix A. Noun names and alphanumeric codes used on labels should be consistent with those used in all facility procedures, round sheets, alignment checklists, engineering drawings, and piping and instrument diagrams. Information on control panel labels should be consistent with the information on labels attached to the equipment being controlled. Alphanumeric codes should be developed in a manner that will aid personnel in consistently identifying the correct component and prevent misidentification. For example, two parallel motor

control centers may be identified as MCC-1A and MCC-1B, but identifying them as MCC-1A and MCC-1-1A may lead to confusion.

Abbreviations and acronyms used on labels should come from the facility's approved list of abbreviations and acronyms, and should be commonly understood. Example lists of system designator codes and component function codes are shown in Appendix A.

The following additional guidelines should be considered when developing labels for specific components.

- Labels installed on electrical cabinets, panels, and equipment should indicate the maximum voltage present.

- Labels placed outside doors to rooms should identify the major equipment items contained within.

- Labels for electric motors and other electrical equipment should identify the power supply (e.g., distribution panel, circuit breaker, etc.).

- Labels for pneumatic actuators should identify the respective isolation valves.

- Labels on piping should indicate the contents (or hazard) and the normal flow direction. Piping containing radioactive fluids, toxic materials, or explosive gases should be uniquely marked. (Appendix B identifies a standard method for labeling piping using color codes to indicate the level of hazard.)

Color coding or shape coding can enhance the information presented on a label. For example, facilities having multiple units or parallel trains of equipment may color code labels using a distinctive color for each unit or equipment train, or they may code each unit with a unique label shape (e.g., unit A labels are triangular, unit B labels are rectangular, unit C labels are round). These practices have been shown to reduce misidentification.

Color coding can also be used to identify functional groups of components, such as components connected to the emergency power bus. When color coding is used, it should be applied consistently and have only one meaning for each color or

combination of colors. Appendix B describes several applications of color coding for labels, control panels, and components.

In some facilities, bar coding is added to equipment labels to facilitate automated data taking or maintenance tracking. Facilities involved in extensive relabeling of existing equipment or installation of new equipment systems may find it worthwhile and cost effective to add bar coding.

4.3 Label Placement

Labels should be placed on or near the components being identified in a manner that clearly associates the label with its respective component. Appendix C shows how the method used when applying labels can affect the operator's ease of use and the accuracy of identification.

Labels for components should be permanently attached to the components (e.g., attached to the valve yoke, not to a removable part such as the handwheel) in a way that will not interfere with the normal operational use or testing of the component. Valves operated by reach rods or chains, or other remotely operated components, should have an additional label installed at the operating device. Labels for chain operators should be attached to a small piece of tubing through which the chain passes, so the label always remains at the bottom of the chain loop. If the valve is difficult to be seen from the operating location, the label should indicate the open and close direction for the chain or other operator.

Label materials (including adhesives and other means of attachment) should be compatible with the components and environment where they are used. Labels made with embossed plastic tape frequently curl and fall off the panels to which they have been attached. Metal labels or wire attachments made of dissimilar metals can cause galvanic corrosion of the component, label, or attachment device. Use of adhesives containing chlorides can cause corrosion of stainless steel components. High-temperature, humidity, chemical, or radiation environments may preclude the use of certain label materials.

Labels should normally be constructed of non-reflective materials. This helps ensure readability of the label under a variety of lighting conditions. Labels that must be read in dim light or during blackout conditions may require the use of reflective or phosphorescent materials.

If possible, the text of all labels should be oriented as shown in Figure 1a. Labels for vertical runs of piping and conduit may require that the label be oriented vertically. When vertical labels are necessary, the text should be oriented as shown in Figure 1b. Labels should never be oriented like those shown in Figure 1c.

ZN-690	Z N 6 9 0	ZN-690 ZN-690
Figure 1a. Preferred orientation for all labels.	Figure 1b. Acceptable orientation for vertical labels.	Figure 1c. Unacceptable label orientation.

Labels should be readable from the normal operating location or position (i.e., an operator should not be required to manipulate the label before reading it). The character height of label text should be based on the reading distance, available illumination, and importance of the information.

- The minimum character height for good illumination environments can be determined by multiplying the nominal reading distance by 0.004. For example, if the nominal reading distance for an operator standing directly in front of a panel is 28 inches, the minimum label character height would be 0.112 inches (0.004 x 28 inches).

- The preferred height for label characters giving critical information or in areas of adverse illumination is 0.006 times the reading distance. For example, if the reading distance is 28 inches, the preferred character height would be 0.168 inches (0.006 x 28 inches).

4.4 Replacing Labels

4.4.1 Identifying Lost or Damaged Labels

Facilities should establish procedures to ensure that missing, damaged, or incorrect labels are promptly replaced. Since labels may be removed or misplaced during maintenance activities, facility procedures should require operators to verify labels when the equipment is returned to service. Operators performing component alignments or rounds should verify that labels are present, readable, and undamaged. A column can be added to valve line-up sheets or system alignment checklists to ensure that label condition and accuracy are checked during system line-ups. Checks may also be added to preventive maintenance procedures (PMs), or other procedures, to ensure that components are correctly labeled.

Operators should watch for use of informal labeling methods (e.g., black marking pen) as these may represent places where formal labeling should be applied.

4.4.2 Providing New Labels

The operations supervisor (or other designated management authority) should review and approve all requests for new or replacement labels. Labeling requirements should also be evaluated during the planning of design changes or temporary modifications. Conflicts involving component identification (e.g., inconsistent component numbers or names used in procedures or drawings) should be resolved before labels are approved.

If a new label cannot be immediately provided, a temporary label should be installed until a correct permanent label can be obtained. All labels should be installed by personnel knowledgeable of the components and their function in the system to prevent inadvertent equipment operation during label installation, and to prevent interference with normal component operation. The attachment of temporary or permanent labels should be independently verified to ensure that the label is properly attached to the correct component and all the label information is correct.

Facilities may find it advantageous to obtain label-making equipment, so replacement labels can be produced on site. The EPRI report, *Effective Plant Labeling and Coding*, cited in Section 3, discusses various methods for providing replacement labels and estimates the delay time and the cost associated with each.

SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 5480.19. *Conduct of Operations Requirements for DOE Facilities.*

DOE Order 5480.19, Chapter XVIII, "Equipment and Piping Labeling."

Electric Power Research Institute, EPRI NP-6209, *Effective Plant Labeling and Coding (1989).*

American National Standards Institute, ANSI A 13.1-1996, *Scheme for the Identification of Piping Systems.*

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APPENDIX A
LABEL INFORMATION

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LABEL INFORMATION

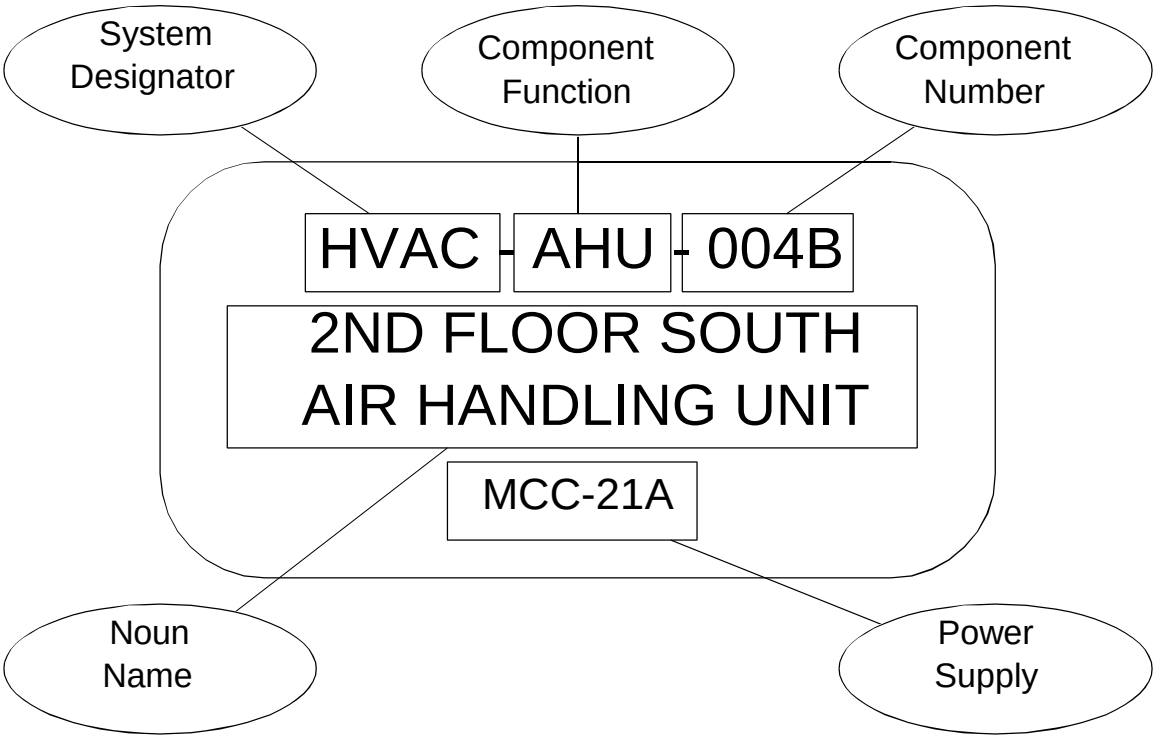

Figure A-1. Label Information

Labels should provide a concise and meaningful verbal description of the function (noun name) of the item being identified. Labels should also provide a unique alphanumeric code identifying the system and the component. In some facilities, particularly where duplicate systems or parallel trains of equipment are used, additional identifying information may be required to ensure that each label uniquely identifies a single component.

Noun names and alphanumeric codes used on labels should be consistent with those used in procedures, drawings, and other facility documents. Any abbreviations or acronyms used in noun names, system designator codes, or component function codes should be standardized, commonly understood, and identified on the facility approved list. It may be helpful to list systems and components by name and by designator to make it easier for personnel to locate the correct name associated with a label code, as illustrated in the following tables.

Table A-1. System Designator Codes

Arranged by System Name

System Name	Code
Air, Compressed	CA
Air, Instrument	IA
Electrical, Low-Voltage (#240V)	ELLV
Electrical, Medium-Voltage (>240V, #4.16kV)	ELMV
Fire Protection	FPS
Heating, Ventilation, and Air Conditioning	HVAC
Steam, Heating	HTS
Steam, High Pressure	HPS
Waste, Process Liquid	LPW
Waste, Sanitary	SWR
Water, Deionized	DIW
Water, Domestic	DW

Arranged by Designator

Code	System Name
CA	Air, Compressed
DIW	Water, Deionized
DW	Water, Domestic
ELLV	Electrical, Low-Voltage (#240V)
ELMV	Electrical, Medium-Voltage (>240V, #4.16kV)
FPS	Fire Protection
HPS	Steam, High Pressure
HTS	Steam, Heating
HVAC	Heating, Ventilation, and Air Conditioning
IA	Air, Instrument
LPW	Waste, Process Liquid
SWR	Waste, Sanitary

Table A-2. Component Function Codes

Arranged by Component Function

Component Function	Code
Air Handler	AHU
Annunciator	ANN
Circuit Breaker	CB
Compressor	CMP
Condenser	COND
Damper	DMP
Heat Exchanger	HX
Indicator, Current (Electric)	II
Indicator, Flow	FI
Indicator, Voltage	EI
Motor Control Center	MCC
Pump	PMP
Transformer	XFMR
Valve, Air-Operated	AOV
Valve, Motor-Operated	MOV

Arranged by Code

Code	Component Function
AHU	Air Handler
ANN	Annunciator
AOV	Valve, Air-Operated
CB	Circuit Breaker
CMP	Compressor
COND	Condenser
DMP	Damper
EI	Indicator, Voltage
FI	Indicator, Flow
HX	Heat Exchanger
II	Indicator, Current (Electric)
MCC	Motor Control Center
MOV	Valve, Motor-Operated
PMP	Pump
XFMR	Transformer

APPENDIX B
COLOR CODING

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COLOR CODING

Color coding may be used in a number of ways to enhance the labeling of equipment and piping, as discussed below. When color coding is used, it should be applied consistently and have only one meaning for each color or combination.

Highlighting Critical Component Controls or Groups of Controls

One common use of label color coding is to provide easy recognition of critical controls, such as emergency stop or emergency shutdown controls. The use of red-on-white or white-on-red labels for these controls can set them apart from the standard labels used on the remainder of the control panel. To further accentuate critical controls or groups of controls, red functional demarcation lines can be used in association with red labels.

Associating Related Controls and Displays

The design of some control panels places gauges, meters, and other quantitative displays on an upper section of the panel and the associated controls on the lower section of the panel. Color coding can be used to help operators rapidly make the correct associations between control-display pairs. Methods include:

- Color-coded display bezels or labels, with matching color control handles or labels

- Color-coded paint patches on the control panel surface surrounding displays and controls.

Showing Functional Demarcation of Controls

Functionally related groups of control panel components can be identified by using taped demarcation lines or the “paint patch” or “color patch” method. When using taped demarcation lines, standard operating controls may be grouped using one color (e.g., black lines), critical controls using another (e.g., red lines), and annunciator controls using a third (e.g., orange or yellow lines), as illustrated in Figure B-1. The “paint patch” or “color patch” method (see Figure B-2) usually consists of a different color background on the control panel for each system, matching the paint colors used on facility components and piping.

Use of demarcation lines that are too bold, or extensive use of color in either of the above methods, can result in a control panel that is visually overwhelming. Consultation with graphic arts or visual communication arts personnel may help avoid problems in this area. Facilities

choosing to use color coding may benefit from testing on a full-scale mockup before applying the coding system to control panels and components.

Preventing Wrong-Unit, Wrong-System, or Wrong-Train Errors

Wrong-unit errors can occur in the performance of operations or maintenance when identical components are used in parallel units. To reduce the errors, a unit color code can be applied to the following:

- Labels
- Walls
- Equipment bases, pedestals, and curbing
- Valve handwheels
- Floors
- Doors
- Stencil marking backgrounds
- Paper used for procedures or other unit-specific documents

Errors in identification also occur when similar or identical components are used in more than one system (e.g., portions of compressed air, fuel oil, lube oil, and cooling water systems may have similar piping and components), or when redundant equipment trains are installed (e.g., identical equipment may be installed in safety monitoring trains A and B). Color-coded labels and other color-coding methods listed above may be applicable to systems and equipment trains. In addition, some facilities have applied color-coded paint to all painted components of designated systems; for example, all piping and components of the compressed air system are painted blue, the lube oil system is painted orange, the steam system is painted tan, etc.

Identifying Hazards in Piping Contents

A standard published by the American National Standards Institute, *Scheme for the Identification of Piping Systems*, ANSI A 13.1-1996, specifies a method for identifying the contents and hazards in piping systems. A standard method of identification is particularly important when components in piping systems may be operated or manipulated by personnel from outside the facility, such as firefighters or outside maintenance personnel. The standard identifies the following practices for labeling piping systems:

- The legend (text) of the label must identify the contents of the piping and the hazard (e.g., “hot water,” “air - 100 psig,” “sulfuric acid,” etc.)

- Arrows must be used with labels to indicate the direction of flow

- The label and arrow, or the pipe itself, should be color-coded to indicate the contents and level of hazard. The following color codes have been identified for this purpose:

Piping Contents	Label Color	Legend Color
Materials inherently hazardous (e.g., flammable, chemically active, toxic, dangerous temperatures or pressures, radioactive)	Yellow	Black
Low-hazard liquids or liquid admixtures near ambient temperature and pressure	Green	White
Low-hazard gases or gaseous admixtures near ambient temperature and pressure	Blue	White
Fire quenching materials (e.g., water, foam, CO2, Halon, etc.)	Red	White

- Labels (with arrows) are required in the following locations:

  - Close to valves or flanges

  - Adjacent to changes in direction and branches

  - Both sides of barrier penetrations (where pipes pass through walls or floors)

  - At intervals on straight pipe runs sufficient for identification.

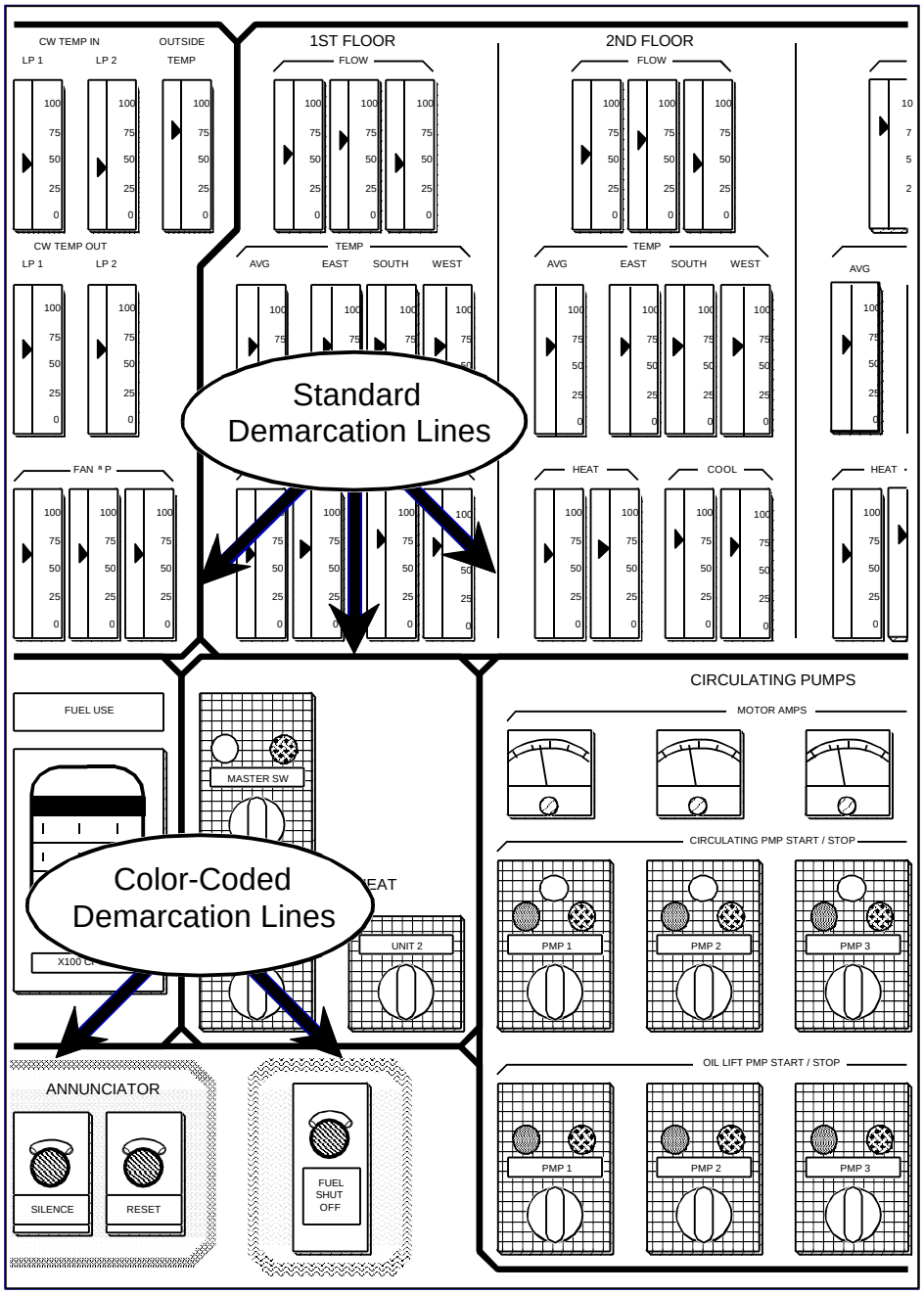

Figure B-1. Demarcation lines on a control panel.

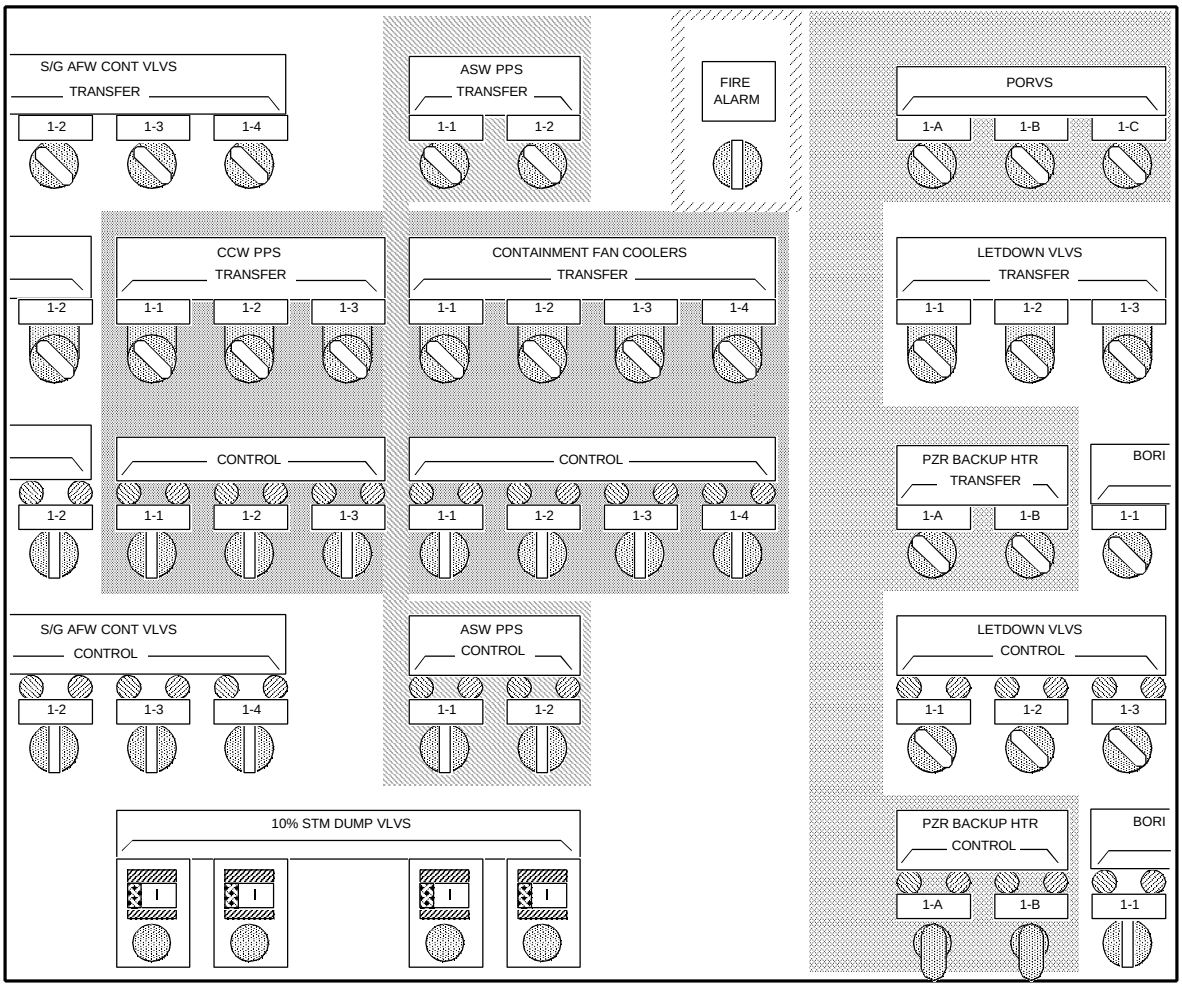

Figure B-2. Color patch method on a control panel.

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APPENDIX C
LABEL PLACEMENT

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LABEL PLACEMENT

Labels should be placed on or near the components being identified in a manner that clearly associates the label with its respective component and removes any ambiguity. Labels on control panels should be consistently placed above, below, or on components so that the operator is conditioned to finding and identifying information accurately. However, even when labels are placed consistently above or below components, the results can be confusing, as shown in Figure C-1.

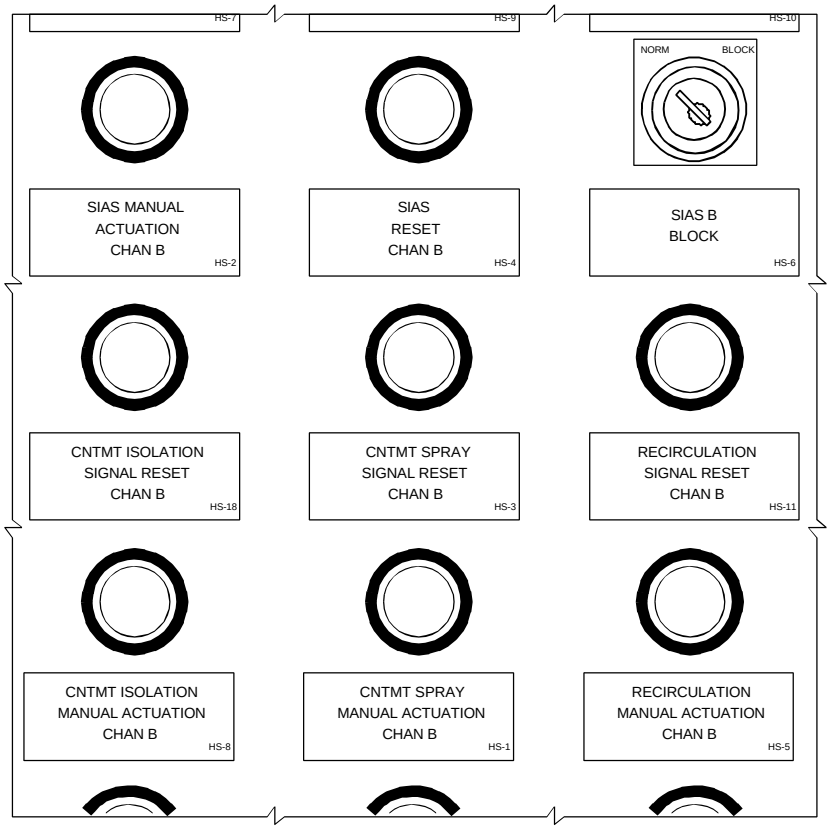

Figure C-1. Labels evenly spaced between components.

To accurately identify the correct label with each component in the portion of the control panel illustrated above, the operator would be required to search for indications of the labeling system used, by checking the top of the panel, the bottom of the panel, or a separate legend. This increases the chance of identification errors.

Where control panels contain many rows or columns of equally spaced components and labels, the facility can reduce the risk of misidentification by “connecting” the labels to the components they identify using brackets or tie lines, as shown in Figure C-2.

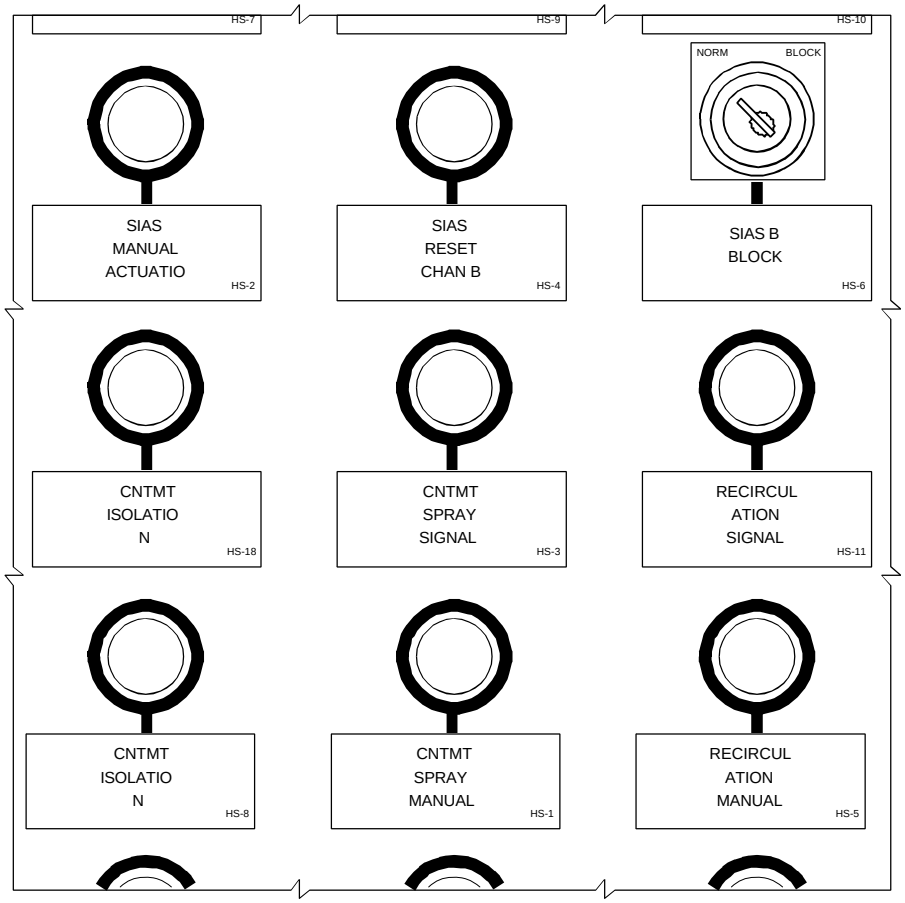

Figure C-2. Labels tied to components.

A better approach to labeling control panels is to place each label closer to the component it identifies than to any other component. The label for a control device (e.g., switch) should be placed above the control so the operator's hand does not block view of the label when operating the control. This method is illustrated in Figure C-3.

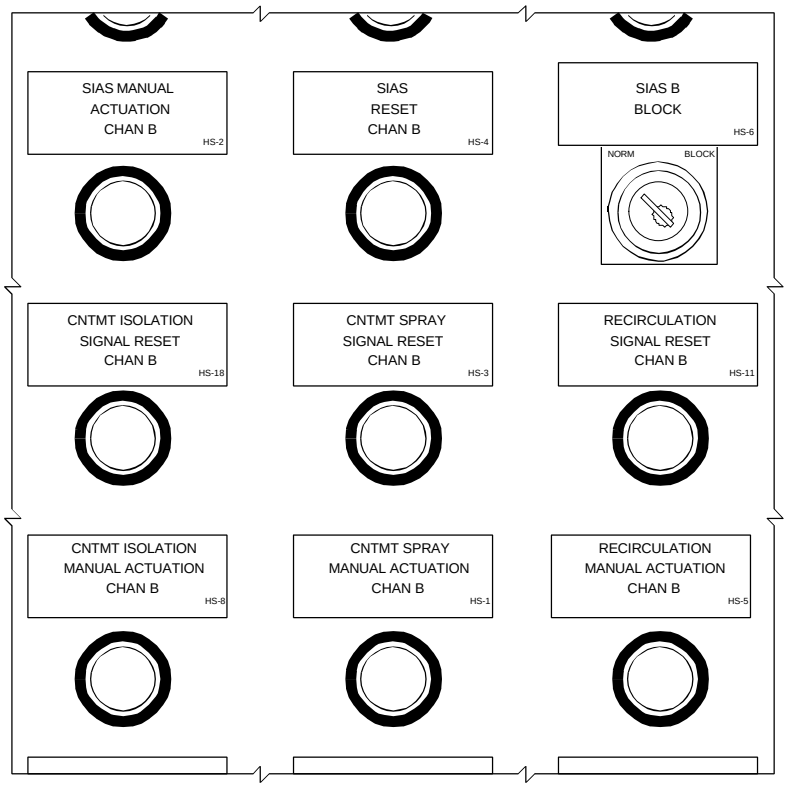

Figure C-3. Labels placed near the components they identify.

A final refinement for control panel labeling is the design of escutcheon plates, i.e., labels that enclose or surround each control panel device. These plates may be simple shapes, or they may be designed as graphic illustrations of the component being monitored or controlled, as shown in Figures C-4 and C-5.

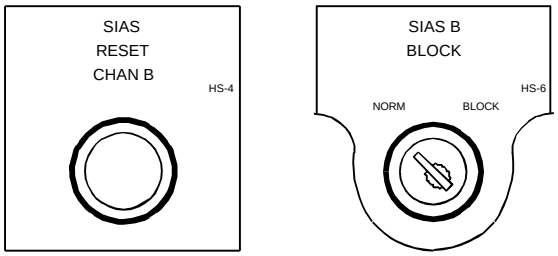

Figure C-4. Simple escutcheon plate labels.

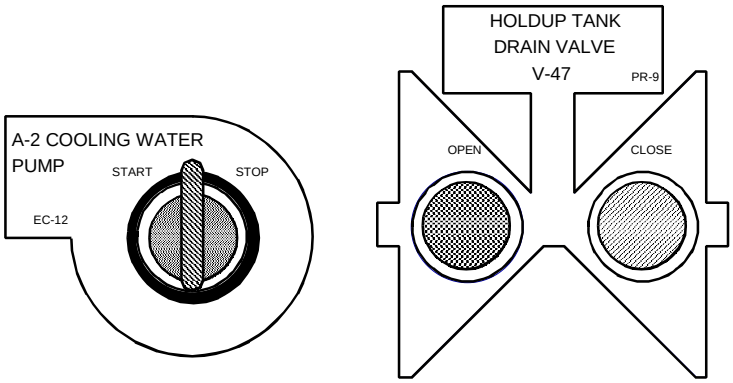

Figure C-5. Graphic escutcheon plate labels.

CONCLUDING MATERIAL

Review Activities:

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Preparing Activity:

DOE-EH-31

Project Number:

FACR-0006

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DOE STANDARD

GUIDE TO GOOD PRACTICES FOR NOTIFICATIONS AND INVESTIGATION OF ABNORMAL EVENTS

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Guide to Good Practices for Notifications and Investigation of Abnormal Events

Page / Section	Change
p. vii / Definitions / first definition	The second sentence was added.
p. vii / Definitions / fourth, fifth, and sixth definitions	The references to DOE Order 5000.3B were updated to DOE Order 232.1A.
p. 5 / Section 3.1 / first paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 5 / Section 3.1 / fourth paragraph	The paragraph was added.
p. 5 / Section 3.2 / first paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 7 / Section 4.1 / fourth paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 7 / Section 4.1.1 / first paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 8 / Section 4.1.1 / second paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
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p. 13 / Section 4.2.4 / second paragraph	The references to DOE Order 5000.3B were updated to DOE Order 232.1A.
p. 14 / Section 4.2.5 / second paragraph	The reference to DOE-STD-1010-92 was removed (document was canceled). The reference to DOE-HDBK-7502-95 was added.
p. 15 / Section 4.2.6 / second paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 16 / Section 4.2.7	The section was added.

Page / Section	Change
p. 17 / Supplemental Resources	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 17 / Supplemental Resources	The reference to DOE-STD-1010-92 was removed, and the reference to DOE-HDBK-7502-95 was added.
Concluding Material	The Preparing Activity was changed from NE-73 to EH-31.

FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

KEYWORDS

Abnormal Event
Near Miss
Report
Root Cause

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DEFINITIONS

Condition	Any as-found state, whether or not resulting from an event, that may have adverse safety, health, quality assurance, security, operational, or environmental implications. A condition is more programmatic in nature; for example, an error in analysis or calculation, an anomaly associated with design or performance, or an item indicating a weakness in the management process are all conditions.
Event	A real-time occurrence happening (e.g., pipe break, valve failure, loss of power, environmental spills).
Near Miss	A situation in which an inappropriate action occurs (or a necessary action is omitted) but is detected and corrected before an adverse effect on personnel or equipment results.
Notification Report	The initial documented report, to the Department of Energy, of an event or condition that meets the reporting criteria defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. A notification report is part of the occurrence report.
Occurrence Report	A documented evaluation of an event or condition that is prepared in sufficient detail to enable the reader to assess its significance, consequences, or implications and to evaluate the actions being proposed or employed to correct the condition or to avoid recurrence. The format for occurrence reports is contained in DOE Order 232.1A.
Reportable Occurrence	Events or conditions to be reported in accordance with the criteria defined in DOE Order 232.1A.
Root Cause	The cause that, if corrected, would prevent recurrence of an abnormal event or a similar occurrence.

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GUIDE TO GOOD PRACTICES FOR NOTIFICATIONS AND INVESTIGATION OF ABNORMAL EVENTS

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, "Notifications," Chapter VII, and "Investigation of Abnormal Events," Chapter VI, of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The practices in this guide should be considered when planning or reviewing programs for notifications and investigation of abnormal events. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Notifications" and "Investigation of Abnormal Events" are elements of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for a coordinated notifications program and a consistent method for investigating abnormal events to promote safe and efficient operations.

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2. OBJECTIVES

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

2.1 Notifications

A program is established to provide timely notifications to appropriate DOE personnel and other agencies to ensure that the facility is responsive to public health and safety concerns.

Criteria:

1. Facility procedures are developed to ensure appropriate notifications.

2. Notifications are appropriately documented.

3. Adequate communications equipment is maintained to meet notification requirements.

2.2 Investigation of Abnormal Events

An established and thorough review process ensures that all significant aspects of an abnormal event are identified, investigated, and resolved.

Criteria:

1. Facility guidelines identify specific events and "near miss" situations that require investigation.

2. Responsibilities for investigative tasks are understood by personnel.

3. Personnel performing investigations are qualified in the facility's investigative process through experience and training.

4. Information required for the investigation is collected as soon as possible during and after the occurrence of the event.

5. A structured review is performed to identify the root cause and corrective actions to prevent recurrence of each abnormal event.

6. A timely and comprehensive investigative report is prepared and disseminated, including entry into the Occurrence Reporting and Processing System (ORPS).

7. Events are evaluated to determine what training is appropriate.

8. Follow-up review is performed to evaluate the effectiveness of corrective actions and determine patterns of deficiencies.

9. Acts of known or suspected sabotage are immediately investigated.

3. DISCUSSION

3.1 Notifications

An effective notification program provides a positive means for the facility to respond to public health and safety concerns. Department of Energy policy encourages a positive attitude toward reporting occurrences. Facilities should develop notification guidelines that are directed toward ensuring uniformity, efficiency, and thoroughness of notifications consistent with the requirements of DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

The need for facility-specific notification guidelines is apparent if one considers the situation of a supervisor during, and immediately after, a serious operating event. The supervisor's first priority is to ensure safety. This may involve implementing emergency operating procedures, reassigning operating personnel, and/or personally supervising immediate actions. In the midst of this activity, the supervisor requires concise notification guidelines that clearly indicate the appropriate level of notification for the specific event, based on an evaluation of its potential to impact safety, health, the environment, or operations. The supervisor also needs to know the time available to make the notification within regulatory requirements, the individuals to be notified, and the method to be used to notify each.

Well-designed guidelines will ensure that notifications do not interfere with the immediate actions that are needed in response to abnormal conditions. They should also ensure that notifications are regarded as an integral part of the response, not an action to be considered after conditions have returned to normal.

A manager has overall responsibility for the event investigation process. However, the manager may delegate specific tasks in the investigation process to other personnel as appropriate.

3.2 Investigation of Abnormal Events

Prompt investigation of abnormal events and conditions is important so facilities can assess the impact of each event or condition, determine the root cause, and identify corrective actions to prevent recurrence. Abnormal events and conditions include all occurrences requiring formal notification under DOE Order 232.1A. Additionally,

investigation is appropriate for all events, conditions, "near misses," or other indications of situations within or outside the operations organization that, if uncorrected, can impact safety or reliability. Acts of actual or suspected sabotage represent a special case for investigation.

The investigative process described in this guide is intended to assist the operating organization in evaluating and responding to operational abnormalities. These investigations are not intended to replace the formal Type A, B, or C investigations that are required for certain occurrences in accordance with DOE Order 5484.1, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*, although both investigations have similar objectives. Consider again the situation of a supervisor immediately after a serious operating event. Even though immediate actions have been taken in accordance with appropriate procedures, the event may still impact personnel or facility safety. Therefore, it is important that the operations organization begin the investigative process as soon as possible.

To ensure consistency, facilities should provide written guidelines to address all aspects of the investigative process. Concise instructions will aid the supervisor in properly collecting and/or preserving physical evidence that may be needed in the investigation. Standard forms, or an example format, will aid in documenting statements from the personnel present during the event. Checklists may be useful for ensuring that all appropriate operating records (e.g., recorder charts, round sheets, logs) are collected or copied for use in the investigation. Finally, clear instructions for conducting the investigation will make effective use of time and will aid personnel in evaluating the corrective actions taken and the results of those actions. This process will enable personnel to determine the current safety status of the facility and the capability for continued operation.

4. GOOD PRACTICES

4.1 Notifications

The notification program should ensure that DOE and DOE contractor line management are kept fully and currently informed of all occurrences that could (1) affect the health and safety of the public, (2) seriously impact the intended function of DOE facilities, (3) have a noticeable adverse impact on the environment, or (4) endanger the health and safety of workers.

Responsibility for the occurrence has no bearing on the notification process; the agencies and organizations that must respond to the occurrence require prompt notification so that appropriate emergency procedures can be implemented. Reportable occurrences may result from equipment failures, fires, loss of electric power, or even dangerous weather conditions that are capable of causing a release of hazardous or radioactive materials. Certain classes of security incidents may also require prompt notification.

Another function of the notification program is keeping DOE and facility management informed of conditions that could affect the facility's ability to perform its mission. This is necessary to enable proper allocation of human and material resources. For example, non-availability of spare parts for an aging pump may threaten to disable a critical system. Appropriate notification regarding this condition will alert management to the problem. Management may then initiate an engineering review, leading to a budgetary request for a replacement pump of a newer design, for which spare parts are available.

DOE Order 232.1A provides criteria for evaluating the seriousness of each occurrence and determining the appropriate notification category, i.e., emergency, unusual occurrence, or off-normal occurrence. For each notification category the Order specifies the method, time, and documentation requirements. It also lists examples of occurrences as an aid to facilities in preparing their own specific guidelines for categorizing occurrences.

4.1.1 Notification Procedures

Facilities should establish notification procedures consistent with DOE Order 5480.19, Chapter VII, "Notifications," and DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. These procedures should include:

- Guidelines identifying facility events and conditions that require notifications

- Specific responsibilities for categorizing occurrences and making notifications

- Up-to-date identification of primary and alternate personnel to be notified for various occurrences, including all necessary information for contacting each person (i.e., telephone number, pager number, etc.)

- Time requirements for notifications consistent with the facility emergency plan.

Notifications for some categories of occurrences can be made electronically through the Occurrence Reporting and Processing System (ORPS). DOE Order 232.1A includes specific instructions for completing each data field in the occurrence report.

Facilities should provide training to ensure consistent application of the notification procedures. The training for involved personnel should include categorization, notification, and associated reporting requirements. In addition, training for all personnel should address the philosophy of occurrence reporting to develop a positive attitude toward reporting occurrences and to emphasize the importance of timely reporting and follow-up notification. Persons at the "worker" level in the organization may not have formal responsibilities for the notification program; however, their input through normal reporting to their supervisors is essential to the success of the program. More information concerning reporting of abnormal operating conditions is contained in DOE Order 5480.19, Chapter II, "Shift Routines and Operating Practices."

4.1.2 Documentation

Documentation is an essential part of the notification process. From a practical viewpoint, documenting the reason for the notification, time, and identity of the person(s) notified can prevent confusion and permit more focused attention on the immediate actions necessary to mitigate an ongoing event. In some

situations, the documentation can help persons on the scene of an occurrence determine what type of assistance they may expect and when it should arrive.

All notifications made in accordance with DOE Order 232.1A require formal documentation in a notification report. Facility procedures should establish a format, such as the notification report format, for documenting notifications at all levels. Facilities should consider the use of fill-in-the-blank forms to document notifications for different types of situations. These forms can serve as a checklist for personnel on the scene of an occurrence, helping ensure that all notifications are made as required.

4.1.3 Communication Equipment

Facilities should ensure that adequate communication equipment is accessible to meet notification requirements. They should evaluate their potential for public endangerment or harm to the environment, and determine what alternate methods of notification are needed in the event of primary communications equipment failure. High-risk facilities commonly use dedicated phone lines or data links as the primary method for emergency notifications, backed up by ordinary phone lines, radio networks, and other methods. Low-risk facilities may be adequately served by ordinary phone lines, supplemented by paging devices if notifications may be required for off-shift or roving personnel.

Emergency communication systems for informing on-site personnel of hazards or conditions requiring their immediate attention are addressed in DOE Order 5480.19, Chapter IV, "Communications," and in DOE-STD-1031-92, *Guide to Good Practices for Communications*.

4.2 Investigation of Abnormal Events

Facilities should establish specific guidelines for investigations of abnormal events. The guidelines should help personnel determine when investigation is required, who is responsible for the investigation, how the investigation is to be conducted, and what documentation is required. The guidelines should emphasize that the purpose of investigations is to improve operations.

4.2.1 Events Requiring Investigation

Facilities guidelines should define events that will require investigation. All events that could adversely affect operations or safety should be investigated at an appropriate level. The following examples are typical of events that should be investigated:

- Design limits (e.g., Technical Safety Requirements, Safety Analysis Report, or other limits) have been violated
- Facility safety conditions are abnormal or unexplained
- Safety or system features are improperly positioned
- Equipment failure that could affect facility capability or safety has occurred
- An unplanned shutdown or significant loss of operation has occurred
- A procedural violation or personnel error has occurred that causes, or could have caused, serious personnel or equipment damage or could have affected facility safety
- Radiological or toxic material limits have been exceeded or radioactive or toxic material lost/released
- Facility system performance is unusual, abnormal, or unexplained
- Chemistry or process parameters are out of specification or indicate unexplained trends
- Repetitive problems have occurred
- Actual or attempted sabotage is suspected
- Loss of Special Nuclear Material has occurred or is suspected

- A department head or the facility safety review committee deems an investigation is appropriate.

"Near miss" situations often serve as indicators of underlying problems and should therefore be investigated. The following are some examples of near misses:

- An operator action was not performed, or was performed improperly, but the error was identified and corrected before the process was damaged. The near miss may indicate a problem in the operator's training or the operating procedures.

- A maintenance activity, such as calibration or testing, produced a transient in an operating system; the system was prevented from upset only by the response of an attentive operator. The near miss may indicate a problem in the maintenance procedures or may point to a need for better coordination of operations and maintenance activities.

All events that require notification to DOE (in accordance with DOE Order 232.1A) or reporting to other agencies (e.g., Environmental Protection Agency) should be investigated.

4.2.2 Responsibility and Qualification

Responsibility for investigating, reporting on, and identifying corrective actions for abnormal events rests with management, although specific investigative tasks may be delegated. When the root cause of the event has been determined and documented, management should ensure that appropriate corrective action is initiated to prevent recurrence of this or similar events.

Personnel assigned as investigators should be technically qualified, knowledgeable of factors affecting human performance, and trained in investigative methods, such as root cause analysis and interviewing techniques. They should maintain an unbiased attitude in relation to the event being investigated and the personnel involved at the time of the occurrence.

The operations manager is responsible for event investigations involving plant operations. The operations manager may delegate specific investigations or

portions of investigations to other personnel. For example, the initial review following a plant transient might be conducted by the on-shift shift manager; the results of this investigation will establish the need for further review.

4.2.3 Investigative Process

The process of investigation begins with collecting data. Facility guidelines should identify the types of information that will be needed in an investigation, and the methods that should be used to collect and preserve the information. Operations logs, round sheets, and statements from persons present during the event would typically be required for any investigation. Use of prepared forms for personal statements can aid in obtaining and documenting relevant information for the investigation. A sample personal statement form is shown in Appendix A.

Some events may warrant collection of physical evidence such as: recorder charts, readouts from monitoring equipment, photographs and/or drawings of the area, procedures, technical documents, broken or failed components, and laboratory analyses. In some situations, it may be necessary to quarantine certain equipment or systems until the investigation is finished. As soon as possible after an event, personnel should be assigned responsibility to collect and/or preserve appropriate information and evidence.

A structured review of the abnormal event should be initiated when all data has been collected. The format of the investigation depends on the significance of the event. The steps detailed below should be included in each investigation.

a. Event Reconstruction

The abnormal event should be reconstructed using the collected information. When applicable, this is best accomplished using the sequence of events recorder printout as a basis. A chronological list of events is developed. It is desirable to include the personnel involved in the event in the reconstruction process.

b. Event Analysis and Evaluation

Once the facts have been established, the event may be analyzed to determine the responses of equipment and personnel. During the analysis, actual and expected responses of facility systems, adequacy of procedures,

and factors affecting human performance are compared. An evaluation to identify any detrimental effects on plant equipment should be included. The event should be compared with previous investigations of similar events or transients. If the event was a reactor trip, the acceptability of restart is determined.

c. Root Cause Determination

The root causes of the event should be determined whenever possible. Root causes are those fundamental causes that would have prevented the event from occurring and, if corrected, prevent recurrence. Typically correctable without additional research or analysis, root causes explain why direct causes existed.

d. Corrective Action Determination

Each event investigation results in corrective action being established, and specific personnel are assigned responsibilities for such action. Corrective action can be procedure changes, training, design modifications, and administrative controls changes; and may include better supervisory involvement and oversight of work activities and increased worker accountability. Interim compensatory actions may be used while longer-term corrective actions are being developed. Cognizant managers should agree to each corrective action before it is performed, and the facility manager approves it.

4.2.4 Investigative Report

An essential part of the investigation is informing others, so recurrence of the event can be prevented. A report of the investigation, including discussion and explanation of the results of the analysis and identification of the corrective actions, should be prepared in accordance with facility guidelines. The investigation report should be reviewed by appropriate managers, supervisors, and the safety review committee to ensure that lessons learned from the event are identified and incorporated into applicable facility programs as discussed in section 4.2.5. The final report should be reviewed and approved by the facility manager.

Those occurrences requiring formal notification, in accordance with DOE Order 232.1A, also require a formal occurrence report. Instructions for

entering the information into the Occurrence Reporting and Processing System (ORPS) are contained in DOE Order 232.1A. Facilities should also consider providing information of interest directly to other facilities, as described in the *Root Cause Analysis Guidance Document*, DOE-NE-STD-1004-92.

4.2.5 Further Evaluation

The final phase of the investigation consists of follow-up activities, to determine if the corrective action has been effective in resolving the problem. Facilities should analyze events to determine trends or patterns of deficiencies. A mechanism should be established for periodically summarizing events, causes, and trends, and reporting this information to the facility manager, department heads, and appropriate managers.

DOE-HDBK-7502-95, *Implementing U.S. Department of Energy Lessons Learned Programs, Volume 1*, contains guidelines for evaluating and incorporating operating experience into training programs. In many cases, information related to the event may be used both in the initial training received by all operators, and in the continuing training required periodically to maintain operator qualification. Operating experience should also be incorporated, as appropriate, into other facility programs and documents, e.g., procurement, quality assurance, maintenance practices, procedures, radiation control (Rad Con) manuals, and engineering.

The operations supervisor should evaluate all in-house events to determine whether training is required on an immediate basis for operations personnel. Training on events of immediate concern should be provided before personnel begin work on their next shift. The supervisor may use the following methods to address immediate training requirements:

- Ad hoc training sessions

- Shift briefings conducted by the supervisor or other appropriate personnel (discussed in DOE Order 5480.19, Chapter XII, "Operations Turnover")

- Written instructions to oncoming operating shifts (discussed in DOE Order 5480.19, Chapter XV, "Timely Orders to Operators")

- Required reading materials (discussed in DOE Order 5480.19, Chapter XIV, "Required Reading," and in DOE-STD-1033-92, *Guide to Good Practices for Operations and Administration Updates through Required Reading*).

4.2.6 Sabotage

If an act of sabotage is discovered or suspected, the investigative process is essentially the same as that described for other abnormal events, although different priorities may apply. The following items should be considered when setting priorities in sabotage investigations.

- Investigation should be started immediately to determine the condition of the affected system(s) and the operability of all safety-related systems.

- Personnel should consider the possibility that

  - Multiple acts of sabotage may have been committed

  - Safety-related or other critical systems may have been specifically targeted

  - Deliberate steps may have been taken to prevent discovery.

- The appropriate manager or supervisor should determine the capability for continued operation or safe shutdown. This may include independent verification of lineups for some critical safety systems. Guidelines and techniques for independent verification are identified in DOE Order 5480.19, Chapter X, "Independent Verification."

- Corrective actions should include steps to minimize the impact of the sabotage and steps to deter further acts through enhanced security at the facility.

Specific notification criteria for incidents of sabotage are identified in DOE Order 232.1A.

4.2.7 Human Performance Improvement

Minimizing human performance errors is a key to reducing the frequency and severity of station events. To progress toward excellent human performance, a work environment must exist in which workers, leaders, and the organization routinely exhibit behaviors that promote event-free operations. Station management establishes and reinforces operational practices to promote event-free performance. The document Excellence in Human Performance (Preliminary, November 1995) describes individual, leadership, or organizational behavior characteristics that have proven successful in promoting excellence in human performance. Examples of practices that may be beneficial in enhancing station operations include the following:

- Convey an attitude of trust and an approach that supports teamwork at all levels. Actively solicit, listen to, and (if acceptable) act upon workers' ideas for improving individual and organizational performance.

- Encourage communication and teamwork among groups that operate, maintain, and support the facility.

- Establish administrative practices that reinforce desired behaviors.

- Clearly communicate to all personnel the expectations for conducting work and reporting errors.

SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information.*

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter IV, "Communications."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter X, "Independent Verification."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XII, "Operations Turnover."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XIV, "Required Reading."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XV, "Timely Orders to Operators."

DOE Order 5484.1, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*.

DOE-NE-STD-1004-92, *Root Cause Analysis Guidance Document*.

DOE-STD-1031-92, *Guide to Good Practices for Communications*.

DOE-STD-1033-92, *Guide to Good Practices for Operations and Administration Updates through Required Reading*.

DOE-HDBK-7502-95, *Implementing U.S. Department of Energy Lessons Learned Programs, Volume 1*.

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APPENDIX A
(SAMPLE) PERSONAL STATEMENT

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(SAMPLE) PERSONAL STATEMENT

Subject or Title of Event	
Event Date/Time	Occurrence Report Number

In your own words, write down what happened in the event. Include any relevant information from before the event began until after it was over. Include the following:

1. Facility or system conditions as you know them prior to the event.
2. What you were doing immediately prior to the event.
3. Any indications that a problem existed.
4. Your actions in response to the indications.
5. Any equipment malfunctions.
6. Any inadequacies in the procedures, practices, or training.

Completed By	Signature	Date/Time

If additional sheets are used, each sheet should contain: signature, date, time, event title, and occurrence report number.

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CONCLUDING MATERIAL

Review Activities:

DOE
DP
EH
EM
ER
NE
NS

Preparing Activity:

DOE-EH-31

Project Number:

MISC-0016

This draft, November 2000, prepared by EH-53, has not been approved and is subject to modification. Project No. MGMT-0004

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NOT MEASUREMENT SENSITIVE

DOE-STD-XXXX-YR
PROPOSED

DOE STANDARD

PRINCIPLES FOR PROCEDURE SYSTEM MANAGEMENT

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

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Principles for Procedure System Management

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Foreword

1. This Department of Energy standard is approved for use by all DOE Components and their contractors.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data that may improve this document should be sent to the Office of Nuclear Safety Policy and Standards (EH-53), U.S. Department of Energy, Washington, D.C. 20585, by letter or by using the self-addressed Document Improvement Proposal form (DOE F 1300.3) appearing at the end of this document.

3. DOE Technical Standards, such as this standard, do not establish requirements. However, all or part of the provisions in a DOE standard can become requirements under the following circumstances:

(1) they are explicitly stated to be requirements in a DOE requirements document; or

(2) the organization makes a commitment to meet a standard in a contract or in an implementation plan or program plan required by a DOE requirements document.

Throughout this standard, the word "shall" is used to denote actions which must be performed if the objectives of this standard are to be met. If the provisions in this standard are made requirements through one of the two ways discussed above, then the "shall" statements would become requirements. It is not appropriate to consider that "should" statements would automatically be converted to "shall" statements as this action would violate the consensus process used to approve this standard.

This Standard was prepared by the DOE Technical Standards Procedure Topical Committee. Members include: Maggie Sturdivant - EH, Earl Carnes - EH, Charles Billups - SC, Joe King - DP, John Tseng - EM, John Psaras - EM, Fred Carlson, consultant, Dick Nolan, DOE LBNL, Joyce Sylvester – PWI, OR, Peery Schaffer - Bechtel Jacobs, OR, Dan Plung - WSRC, Jacquie Lewis - BWXT INNEL, Steve Greene – UC, LANL, Susanne Guleke – BWXT, PANTEX. The team wishes to acknowledge the assistance of Dr. Daryl Grider and Mr. Bill Mullins for their assistance in the preparation of this Standard.

Purpose

This Technical Standard (Standard) provides principles derived from lessons learned and best practices from within the Department and industry for integrating management and technical knowledge, requirements and standards into procedures that effectively support the missions of the Department of Energy (DOE). These missions include scientific research and development, energy supply, nuclear weapons stockpile stewardship, and cleanup of the environmental legacy from weapons production. This Standard relies on principles rather than on prescription, and promotes reasoned adaptability in recognition of the diversity of work, hazards, work environments, technical complexity, risks, knowledge, and experience associated with accomplishing DOE's missions. Reliance on principle offers two important benefits to providing a critical level of consistency in addressing this very diversity. First, reliance on principle is intended and essential to retaining a consistent and recognized level of proven performance excellence throughout DOE when it comes to codifying proven historical work practices and newly developed work practices into approved procedures. Second, reliance on principle ensures the direction is equally applicable to support all types of mission work: scientific, technical , operational, maintenance, environmental, management and administrative work such as finance and personnel.

Introduction:

Over the past decade changes in DOE's missions have placed heightened attention on DOE's methods for performing work. The result of this focus has been progress in matching work methods to missions. For work where risk is understood, much collective experience has been codified. For work with unconventional risks, good practices are being systematically and continuously learned by those working at the edge of technology to develop standards and procedures for dealing prudently with the unconventional.

Mission changes prompted the Department to establish a tailored standards-based approach for all DOE work. This standards-based approach was developed in response to several factors: DOE's highly specialized and experienced work force was aging and retiring; because of changing social expectations new methods were needed to allow more open disclosure and discussion of how DOE work is performed; new missions posed challenges that are on the edge of current knowledge. The government as a whole was moving toward a system of regulation based on performance accountability. The Department of Energy has responded by developing a body of performance-based policies, contracts, rules and directives.

The standards-based approach is expressed in the DOE Safety Management System Policy, which requires work in accordance with an Integrated Safety Management System (ISMS). This establishes a formal framework to: (1) define work, (2) analyze hazards, (3) develop controls, (4) perform work and (5) use feedback for correction and continuous improvement. These five functions are guided by seven principles which address (1) line management responsibility for safety, (2) roles and responsibilities, (3) personnel competence, (4) balanced priorities, (5) standards and requirements, (6) tailored hazards controls, and (7) authorization of work. This framework is intended to apply in a tailored way to technical work as well as the management and administrative work necessary to accomplish assigned missions.

The ISM Policy is expressed through a hierarchy of agreements that take the form of mission, program, and project descriptions and a variety of local work controls that individuals use to produce the outcomes expected of their work. Work controls, particularly procedures, provide detailed expression of management expectations for completing work tasks.

Throughout DOE the maintained, written documents describing work performance may be referred to by terms such as management controls, work instructions, operations aids, checklists, protocols, administrative controls and standard operating procedures. This diversity of terminology has emerged over time as part of the culture of individual DOE operations. Regardless of the terms used, local level task work controls are considered the domain of procedures. Procedures serve to carry forward the organization's collective knowledge of how to perform work, maintain design integrity, protect the health and safety of people and the environment, and convey the management expectations for the degree of autonomy of decisions and actions available to individual work performers. The value of procedures in promoting the mutual goals of safety and quality is widely recognized by regulatory bodies and professional associations such as the Occupational Safety and Health Agency, the Nuclear Regulatory Commission, the Environmental Protection Agency, the Institute of Nuclear Power Operations, the International Atomic Energy Agency, the Center for Chemical Process Safety, the American Society for Quality and the International Organization for Standards. Just as these bodies do not all mandate the same detailed methods for documenting procedures, so the set of Principles set forth in this Standard is intended to accommodate a wide range of very different work realities.

What the agencies mentioned above do require is procedures that produce consistently high levels of safe, efficient work results. The set of Principles established in this Standard also requires that work performed according to written procedures achieve similar consistently high levels of safety and efficiency. In the past, the Department of Energy has invested extensive effort and significant resources on procedures, with uneven results. Procedures continue to be identified as principal causal factors in DOE accidents, operating events, and lessons learned. Event reviews often specify a lack of management attention to procedure development and procedure system management. To support implementation of Integrated Safety Management at the task work control level, a DOE Procedures Topical Committee was chartered as part of the DOE Technical Standards Program. The intent of this committee is to address procedures from an enterprise view, that is, in a way applicable to all of the Department's work.

The members of the Topical Committee are managers, workers, operators, scientists, engineers and technical specialists from both DOE and contractor organizations who have years of experience with procedures and management systems. To support the ISM goal of doing work safely, the Committee has focused attention on how procedures promote safe, efficient performance. The Committee has worked to foster appropriate procedures that reduce the potential for human error. Members are mindful that imposing inappropriate models of procedures would be counterproductive. The need to avoid the one-size fits all approach to procedures was felt to be an essential aspect of providing guidance that would be productive, supported and used.

A comprehensive set of Principles for procedure system management and procedure development was determined to provide the appropriate level of guidance. Establishing such a set of Principles was deemed to be consistent with both the DOE need for an enterprise approach that respects the diversity of DOE work and the management needs to communicate expectations and maintain awareness of procedure systems and development activities. The guiding concept for these Principles is that the work, the hazards, the environment in which the work occurs, and the skills, knowledge and experience that the work demands give rise to the type of procedures to be used and how procedures will be used to aid in performing work.

Applicability

This Standard can be applied to any DOE mission work. Contractors may use this Standard to tailor their specific methods for managing the development, review, approval, distribution, use, maintenance and retirement of

procedures. This Standard is consistent with and supports requirements and guidance found in 10 CFR Part 830 "Nuclear Safety Management," DOE Order 414.1A "Quality Assurance," DOE G 414.1-2 "Quality Assurance Management System Guide," DOE Order 5480.19 "Conduct of Operations Requirements for DOE Facilities," and DOE Order 440.1A "Worker Protection Management for DOE Federal and Contractor Employees."

Part I: Description of Procedures and Procedure Systems

This section describes the role of procedures, the concept of a procedure system, typical types of procedures, and the relationship of procedures to other management controls.

The Department of Energy has made a commitment that work will be done consistent with contractual agreements, laws and regulations and the principles and functions of ISM. This commitment is to ensure that work is planned, performed, and appropriately documented to protect the environment and the safety and health of the public and workers. This approach to doing work is intended to:

- Increase safety and effectiveness of work
- Support safe and effective human performance
- Allow for good judgment in planning work
- Create consistency and stability in expectations and accountability
- Maintain protection, while establishing a balance between costs and benefits
- Encourage decision making at the appropriate level

Procedures are components of Integrated Safety Management

The procedure system is the broad administrative program that encompasses the development, review, approval, distribution, use, maintenance and retirement of procedures.

Procedures play an essential role in implementing the components of ISM (Figure 1) by:

- Capturing agreements - Capturing the agreements and requirements for performing work as expressed in the approved contract and the ISM System description. DOE and contractors establish up-front agreements on basic approaches to doing institutional, facility and activity work, for example, the acceptable degree of risk associated with particular work. These agreements are established in the contracts, the ISM System Description and associated authorization documents. Procedures integrate these agreements into directions for performing the work.
- Implementing controls - Procedures implement the administrative, design, operating and quality controls.
- Implementing standards - Procedures provide work instructions that implement standards and requirements.
- Supporting human performance - Procedures provide accurate and authorized information and direction to enable individuals to perform assigned tasks safely and effectively.

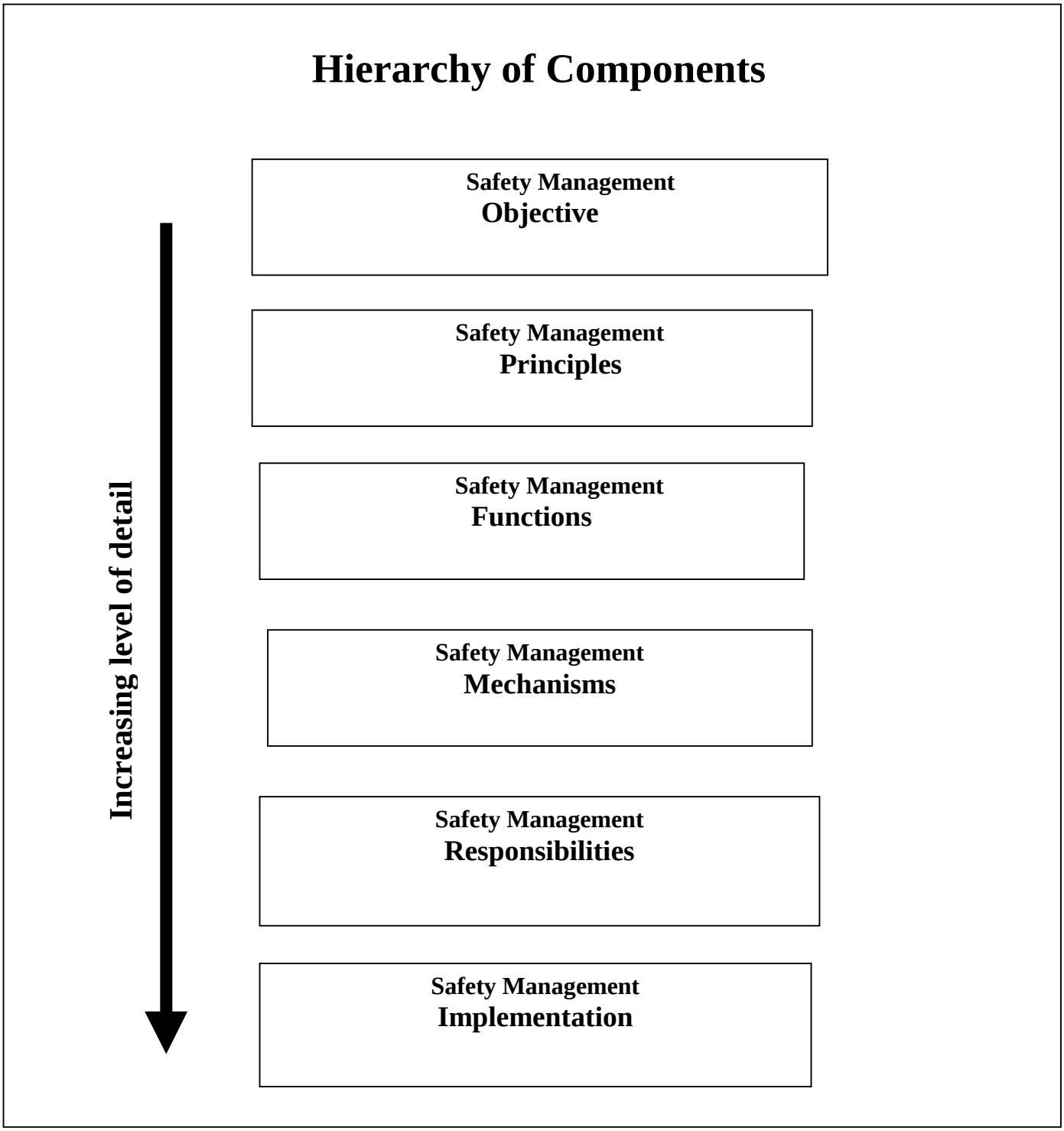
Hierarchy of Components
Safety Management
Objective
Safety Management
Principles
Safety Management
Functions
Safety Management
Mechanisms
Safety Management
Responsibilities
Safety Management
Implementation
Increasing level of detail

Figure 1

For most DOE work, implementation of work design, expectations, requirements and standards are communicated through a set of interrelated documents. Depending upon the work involved, risk, or safety implications, a document hierarchy may be needed to express and achieve full implementation, for example, to communicate policy and direction, support effective human performance, provide necessary information, establish an organization's written intent to comply with applicable regulations and commitments, and to direct task activities.

Figure 2 provides an example of a document hierarchy for capturing and implementing expectations, requirements, commitments and direction.

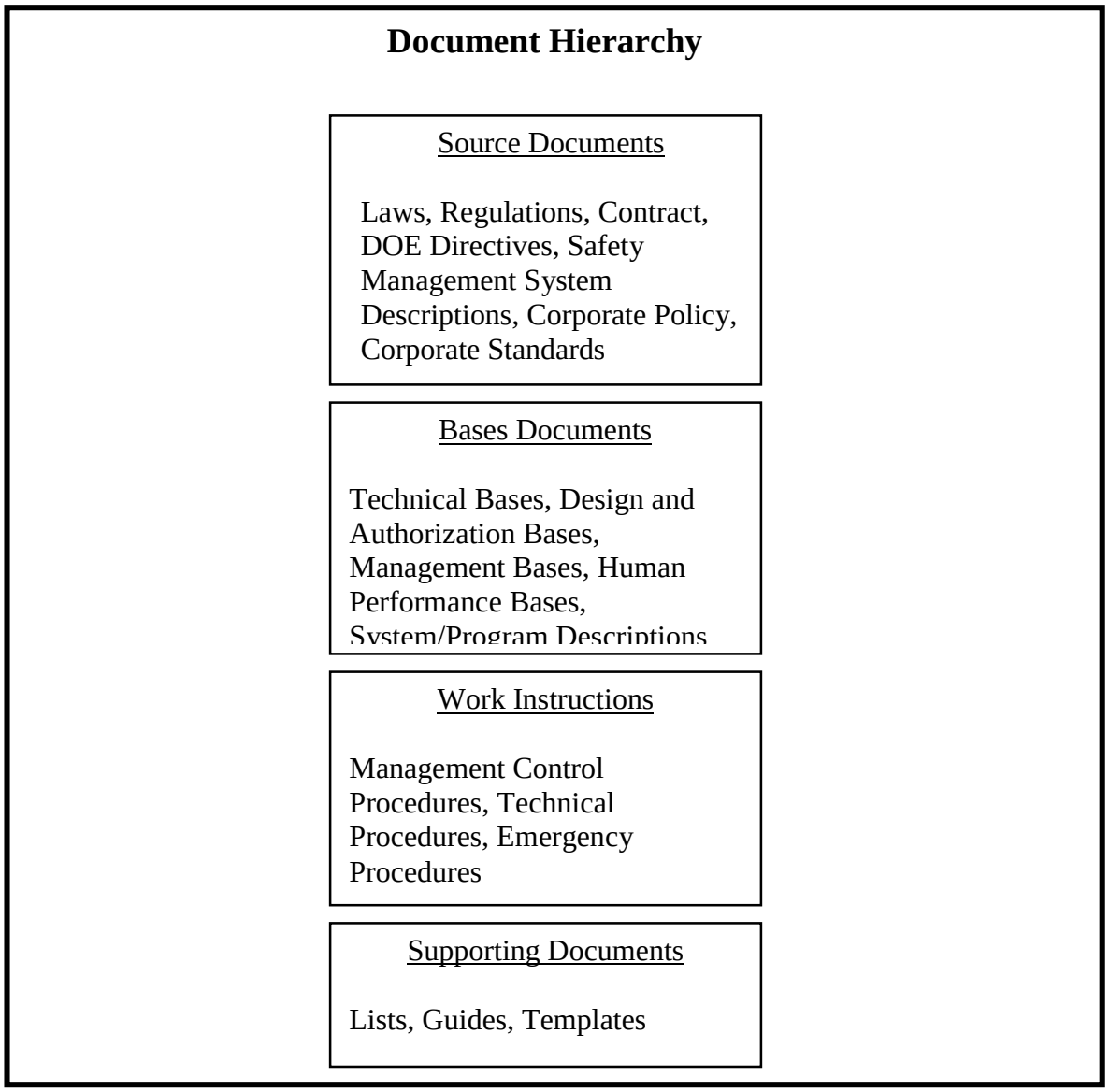

Figure 2

As illustrated in Figure 2, work control is the jurisdiction of procedures. Within the control document types, only procedures establish task direction for how administrative, technical, and emergency activities are to be accomplished. Procedures, in other words, constitute the document type by which work is actually accomplished.

To ensure procedures represent a commitment to doing work safely and effectively, procedures are products of professional collaboration and integration of the knowledge and experience from multiple disciplines. Line management, subject matter experts and workers are responsible for ensuring that procedures are correct and usable. That is, they are responsible for ensuring that procedures:

- Support work accomplishment in the safest, most effective way
- Fully implement the standards and commitments
- Are compatible with related procedures, programs, and initiatives
- Are as easy to comprehend and as easy to perform as possible
- Are consistent with the guiding principles and core functions of ISM

Procedures support different types of work

Procedures are tailored to precisely and effectively support the levels of work: institutional, facility and activity. Because work activities and situations require different means for communicating effectively to personnel performing the work, different procedure types may be needed. These procedure types differ in level of detail and format consistent with their intended application and the bases used for their development.

- Management Control Procedures

Management control procedures, most typically associated with institutional-level activities, provide formal direction for accomplishing interactions, maintaining communications, and ensuring consistency of operations. Management control procedures define the processes (methods) required to ensure that the goals and objectives of the organization's programs are implemented. They are sometimes referred to as administrative procedures, program descriptions or management system descriptions. Unlike technical procedures, management control procedures are not directly used to operate or maintain facilities or equipment. Collectively, management control procedures describe a comprehensive set of controls, interactions, and communications deemed essential by management for the safe and efficient operation of the entire organization. One way of thinking about Management Control procedures is that they translate policy into action. They are based less on quantitative analyses and design standards than on the management’s philosophy of operation, and agreements on how operations will be accomplished. In some ways, they represent much of the “culture” of the organization. For instance, one company might require plan of the day meetings to transmit lessons learned; another might opt for classroom training to communicate recently learned lessons; while a third company might choose required reading; and a fourth company might employ all of these options. The method is tailored to meet the management’s strategy for meeting its corporate goals and commitments.

Examples of activities most typically administered by management control procedures include:

- Quality assurance
- Configuration management
- Personnel management
- Emergency management
- Fire protection
- Human performance
- Work planning
- Safeguards and security
- Lessons learned

- Technical Procedures

Technical procedures focus primarily on accomplishing facility and activity level activities. They are based upon design controls (specifications, drawings), operational controls (documented safety analysis reports, technical specifications), management controls (industrial safety, training) and experience (lessons learned programs). Technical procedures provide direction and information on how to accomplish the technical tasks associated with the full life cycle of performing work, including:

- conducting research
- design
- construction
- testing,
- starting up,
- operating,
- periodically surveilling the equipment, facilities, and processes,
- maintaining,
- shutting down,
- transitioning to new missions
- deactivation and decommissioning

- Alarm Response and Emergency Procedures

Alarm response and emergency procedures delineate the steps to take when an abnormal condition exists. Alarm response procedures signal when operations approach established safety margins, allowing appropriate intervention prior to encountering conditions that are more serious. Emergency procedures detail the responses when safety margins have been breached or seriously jeopardized. Both alarm response and emergency procedures are based upon systems design specifications, safety analyses, hazards analyses, process flow diagrams, and vulnerability studies.

Summary

Procedures communicate direction for performing work when the consequences of that work are important to safety, quality and regulatory compliance. For many types of work, the use of procedures is required by regulation or corporate policy. To support effective safe work, procedures must be based on the work to be done, hazards or business vulnerabilities associated with that work, appropriate requirements, standards

and expectations. The purpose of a procedures management system is to control the development and maintenance of procedures so that individual procedures and the collective set of procedures support effective, safe work throughout the organization.

Part II: Principles for Procedures

Part II contains (1) principles on which a comprehensive procedure system is based, (2) principles by which procedures are developed and (3) principles for supporting the procedure system though the organization's infrastructure. Within the framework of these principles, specific criteria and system elements can be developed based on the work to be performed. Each principle is followed by an explanation of why the principle is significant, what it entails, and how it is fulfilled. In some instances, there is overlap among explanations. This overlap is intentional and warranted not only to support the different types of users, but also to afford each principle sufficient depth so that it can be understood both as an independent principle and as one part of an integrated system.

Fifteen principles are identified for developing, reviewing, approving, distributing, using, maintaining and retiring procedures and managing these procedure functions. To promote a clearer understanding of the interrelationships among the principles, they are organized into three categories.

Procedure system principles. These principles establish the necessary management controls for a procedures system to support the principles and functions of ISM.

Principle 1: The procedure system is an integral component of the Integrated Management System.

Principle 2: The management of procedures is established through policy.

Principle 3: The organization directs when and how procedures are to be used.

Principle 4: Authority and accountability for the procedure system and for individual procedures are defined.

Procedure process principles. These principles establish the necessary controls for the identification, development, review, approval, maintenance, continuous improvement, and evaluation of procedures.

Principle 5: The procedure process begins with identifying the need for procedures.

Principle 6: The procedure bases are identified and documented.

Principle 7: Standards are defined for procedure development and design

Principle 8: Affected organizations conduct formal reviews of procedures.

Principle 9: Procedure verification and validation are required prior to use.

Principle 10: Procedure authorization attests to procedure usability and readiness to implement.

Procedure system support principles. These principles address the interrelated programs needed to ensure the procedure system functions effectively and maintains procedures over time.

Principle 11: Change control is established for procedures.

Principle 12: A document control and delivery system ensures that the correct and current versions of procedures are available for use.

Principle 13: Procedure records are accessible and retrievable

Principle 14: Information management resources support the procedure system.

Principle 15: An effective training and qualification program supports the procedure system.

Procedure System Principles

An effective procedure system produces work-focused, accurate and usable procedures, integrates input for performance of work communicated from other management control systems, and incorporates ISM principles and functions for performing work at all working levels.

- A Procedure System is established for developing, reviewing, approving, distributing, using, maintaining and retiring procedures
- Procedure management and use are established through policy
- Responsibilities and accountabilities are assigned for the procedure system and the procedures
- Mechanisms are identified for integrating work inputs communicated through other management control systems

Principle 1: The procedure system is an integral component of the Integrated Safety Management System

The ISM Principles and Core Functions are codified through contracts, the ISM System Description and associated documents that collectively comprise an organization's management controls. The procedure system is a mechanism that supports institutional, facility and activity work consistent with requirements, standards, management, technical and performance bases, agreements and commitments. The organization's hierarchy of documents should clearly describe the procedures system and how the guiding principles and core functions of ISM are used within the procedures system.

<u>Evidence that the Principle is fulfilled</u>

To fulfill this principle, an organization should describe how it controls the development and maintenance of procedures. Descriptions may be documented at the institutional,

facility or activity level. Descriptions include the organization's overall policy on procedures, the organizational roles and responsibilities for procedure development and maintenance, and the management controls that inter-relate to perform procedure management functions.

Principle 2: The management of procedures is established through policy.

An organization's policy on procedures is derived from the nature of the work, i.e., the levels of complexity and uncertainty involved and the hazards associated with that work. The appropriate degree of formality of procedures and documentation should be tailored to the work and hazards. Policy on procedure system management should be conveyed using the appropriate levels of the organization's document hierarchy such as the Safety Management System Description, formal policy statements, program descriptions or standards.

The function of the Procedure System

Policy should set the management expectations for developing, reviewing, approving, distributing, using, maintaining and retiring procedures.

Evidence that the Principle is fulfilled

To fulfill this principle, establish policy for:

- The procedure management system
- The functional purposes and limitations of procedures

Principle 3: The organization directs when and how procedures are to be used.

All activities associated with defining the procedure system, developing the procedure process, and ensuring suitable support and integration are aimed at making procedures available to increase safety, maintain quality objectives, and enhance human performance. Clear and unambiguous direction should stipulate when to use, how to use and who should use the procedures once approved and issued. To support a clear and consistent use of procedures, requirements are established on use, documentation of use and verification of use. The organization should identify circumstances in which formal, written procedures will be required to promote and support the safe and effective performance of work. At the same time, the organization should define work where controls other than written procedures are more appropriate to accomplishing work safely and efficiently. Procedures may not always be the best vehicle to solve process, performance, integration, and safety problems. Boundaries should be established on the work situations requiring formal written procedures, and those situations in which work plans or verbal instructions combined with worker qualifications and experience provide sufficient assurance that work can be performed safely.

Determining when and how procedures are to be used

- Identify the types of procedures that the organization intends to use
- Establish the criteria for determining which steps in a procedure are to be documented as they are completed, and which are to be independently verified.
- Establish who is responsible for using procedures
- Establish how to use procedures, i.e., reference only, in-hand, or verbatim compliance
- Establish how procedure use will be verified and documented
- Establish what to do during actual use of a procedure if something unanticipated occurs, if an emergency situation arises, or if steps delineated in a procedure cannot be followed as written.
- Determine the levels of training, experience and qualification associated with procedures and their use
  - when training must include formalized testing and qualification
  - what allowances to make for skills associated with craft competency

Evidence that the Principle is fulfilled

To fulfill this principle, establish direction on when to use, how to use, who will use procedures and how procedure performance is documented.

Principle 4: Authority and accountability for the procedure system and for individual procedures are defined.

The procedure system includes development, review, approval, distribution, use, maintenance and retirement of procedures. Authority and accountability should be defined for each of these elements of the procedure system. In addition, authority and accountability should be assigned for individual procedures to ensure procedure quality and to promote procedure ownership. The organization should formally assign authority for performing tasks associated with the procedure system and individual procedures. Accountability is assigned to individuals deemed capable by experience, knowledge and training to perform certain functions for an organization. They have demonstrated they can perform assigned functions and that the organization and the individual(s) have agreed that assigned functions will be performed as expected.

In some instances, authority and accountability may be assigned to different individuals or organizations for each of the procedure types. This separation may be warranted because of the differences in the development and administrative processes for the procedure types, to afford greater attention on each type of procedure, or to support organizational structures (e.g., assigning responsibility for technical procedures to an operating division and management control procedures to an administrative function).

Procedure system accountability

Authority and accountability should be established for the procedure system. Although the overall procedure system may have distributed elements, authority and accountability should be clearly described. Assignment of authority and accountability is also important

to assure availability of resources - personnel, data management, technical expertise (subject matter experts, technical and safety reviews), and associated production resources.

Process accountability

No single individual or organization can ensure that all needed procedures are generated or that all procedures remain current, accurate, and complete. Management must ensure that procedure-related operating experience information is directed into the procedure system so that necessary revisions or improvements may be made. Collectively, all designated procedure owners are held accountable for ensuring that procedures within their purview are developed as necessary and updated:

- When work changes,
- When requirements change,
- When Authorization bases change,
- When feedback identifies opportunities to improve a procedure,
- When procedure deficiencies (errors, omissions) are identified,
- When Unreviewed Safety Questions are identified.

Examples of accountability and authority that should be assigned include:

- Line managers are designated to ensure that procedures:
  - Are consistent with contract provisions,
  - Are in keeping with the approved ISMS,
  - Correctly interface with other procedures,
  - Complement and are consistent with the administrative controls of the procedures system ,
  - Are routinely assessed,
  - Are used as directed by organizational policy.

- Procedure developers (subject matter experts, workers and others as designated by management) are capable of and responsible for developing technically correct procedures that:
  - are work focused,
  - are based on the established design, operating and administrative controls;
  - implement the standards, recognize the operating environment and conditions, and consider the knowledge obtained through lessons learned and related work experience;
  - are designed to optimize human performance,
  - reflect, as in the case of many Management Control procedures, the expectations and philosophy of management;
  - adhere to writer's guides and basic tenets of procedure design.

- Procedure users share responsibilities for ensuring that work experience is appropriately considered, including ensuring that finished procedures can be effectively used in the field under the prevailing work conditions.

- Technical reviewers share the responsibility for making sure that all elements of procedures are true and accurate representations of the work, hazards, workplace, the requirements, and work experience.

- Cross-disciplinary experts share the responsibility to identify and evaluate supporting, affected, and related initiatives and programs when developing or revising procedures.

- Validation personnel are responsible for ensuring procedures, in final form, are usable in the actual environment where the work is to be accomplished.

- The owning organization is responsible for the content, usability and final review. The owning organization confirms that the procedure remains responsive to the original purposes and to the requirements and standards being implemented.

Evidence that the Principle is fulfilled

To fulfill this principle, define accountability and authority for the procedure system, including:

- Designate the line management accountability for the procedure system.
- Designate accountability and authority for development, review, approval, distribution, use, maintenance and retirement of procedures.
- Identify responsibilities for organizational interfaces.
- Identify accountabilities for routine assessment of the procedures.

Procedure Process Principles

The procedure development process is designed to ensure that procedures are accurate and usable and they are consistent with the as-is equipment, work environment, organizational structure, established business agreements and processes, and approved ISM concepts. A comprehensive procedure development process includes the following elements:

- Identification of needed procedures,
- Identification of the bases to support procedure development,
- Qualified, responsible procedure developers,
- Use of established standards for procedure development,
- Interfaces with other procedures,
- Verification through formal interdisciplinary reviews,
- Validation through walk-throughs or similar methods,
- Formal procedure approval to establish accountability,
- Revision and performance evaluation requirements,
- Maintenance of procedures and supporting documentation,
- A method of feedback for continuing improvement.

Principle 5: The procedure process begins with identifying the need for procedures.

Not all work requires procedures, nor do procedures add value to the performance of all work. Training or day-to-day supervision, for example, may be more appropriate and effective for many work activities. Therefore, the first task in a procedure process is to determine which activities need or would benefit from a procedure and to determine the most efficient form of the procedure (for example, traditional 8 ½" x 11" step-by-step, or electronic procedures, job aids, operator aids, decision aids, checklists). This determination is made considering such factors as risk, work experience, lessons learned, informed judgments, capability and constraints (for example, available technology).

Procedures are warranted when any one of the following criteria is met:

- TO REDUCE RISK: When work entails risk to the worker, public, environment or the organization. This criterion is important when any of the following conditions exist:

  - Authorization bases require procedure use
  - Infrequent performance of the operation
  - A complex operation
  - Conditions that entail significant uncertainty
  - A high consequence of error
  - High personnel turnover on the operation
  - Frequent change in information or methods

In addition, procedures may be warranted for reducing significant business risks, e.g., financial or legal liability, intellectual property loss, loss of company-sensitive information.

- TO ENSURE CONSISTENCY: to prescribe a specific way of doing work where consistency is important to safety, quality, human performance or reliability; or where consistency is essential to maintaining compliance with laws, regulations, and commitments.

Evidence that the Principle has been fulfilled

To fulfill this principle, establish guidelines for determining when procedures are needed.

Principle 6: The procedure bases are identified and documented.

The bases documentation, the referenceable collection of documents and information from which the procedures are developed, is the " library" that affords a high level of confidence that the procedures in use are complete, appropriate, usable, technically correct and promote effective human performance. The traceability between the procedures and the bases documentation must be identified and be clear and consistent. All procedures, whether management control, technical or emergency should have an

identifiable basis. However, the bases documents vary. For technical procedures, documents such as hazards analyses and design specifications are principal information sources. For management control procedures bases documents tend to be regulations, standards, and best practices.

An essential step in the procedure process is to pull together or identify the need for current, accurate, complete bases from which to write procedures. The bases may contain any or all of the following based on the work:

Standards basis Management control basis Technical Basis Design and Authorization bases Work Process definition Human Performance basis Operating Experience Procedure Interfaces

Standards basis

A goal of ISM is to have all DOE activities governed by sufficient sets of standards to provide protection during the accomplishment of work. Standards bases are included in approved ISM System Descriptions and listed by contract in Lists A and B. Contracts typically identify requirements and standards that are important for management control, technical and emergency procedures. The standards basis is derived from the work and the hazards (or vulnerabilities) and furnishes essential input from which to develop procedures.

Management control basis

Included in the management control basis for procedures are documents that address commitments to meeting contractual and regulatory obligations, and organizational policy through:

- Administrative programs,
- Operational programs,
- Technical support programs,
- Contracts,
- Memoranda of Agreement/Understanding.

Technical Basis

The technical basis for procedures includes the documents that establish the boundaries within which normal and emergency operations can be performed safely. The Technical Basis includes the design and authorization bases, work process definition, and operating experience.

- Design and Authorization Bases

The design and authorization bases for procedures include design and construction criteria, materials, design engineering drawings and specifications, hazards analyses, documented safety analysis reports, unidentified safety questions (USQ) documents and vendor information. The Authorization Basis may also include facility permits, emergency plans, waste management plans, pollution prevention plans, quality management plans, conduct of operations plans and, in cases of multiple user facilities, tenant agreements.

- Work Process Definition

A significant part of developing the procedure is analysis of the work process, activity, or task represented in the procedure. These analyses examine work sequences: what initiates the action, the steps to be followed in response to that action, and the results from completing those steps. The analyses include potential hazards, vulnerabilities or the areas that increase the probability of errors, and the consequence of these errors. The intent of such analyses is to produce a set of directions and information to be addressed in the procedure, to identify human performance issues, indicate the appropriate warnings and cautions, and determine qualification or training necessary for persons who will carry out the procedure. In Management Control procedures work process analyses focus on maximizing efficiency, cost effectiveness, productivity, and communication.

- Operating Experience

The purpose of collecting and evaluating operating experience is to avoid repeating errors, to continually improve and to learn from others. Operating experience includes experience from within a given organization and from other external organizations that perform similar work. Each DOE contractor organization has a number of systems and processes intended to capture operating experience, analyze causes, identify corrective actions and identify opportunities for continuing improvement. The organization must ensure that these operating experience systems and processes examine and identify causes and corrective actions related to procedures. At the same time, a healthy focus on continuous improvement will encourage identification of opportunities for improved work process flows, introduction of new technologies, automation, and elimination of unnecessary or redundant procedure steps.

Human Performance Basis

The process, activity, task, workplace and organizational factors that affect human performance should be addressed during the procedure development process. Human error is often attributable to management practices, organizational weaknesses, unnecessary or excessive organizational interfaces, equipment deficiencies, adverse environmental conditions or circumstances involving high degrees of uncertainty. In addition, lessons learned during previous or similar work performance should be evaluated to identify potential for error and common types of human error associated with given work or procedures.

Procedure Interfaces

A new procedure or a change to an existing procedure may impact related procedures. The development process should include identifying interfaces with existing procedures and a means to determine if changes are needed to existing procedures to ensure that the collective set of procedures is integrated.

Documenting the Procedure Bases

The bases for procedures should be identified and documented to support development and review of procedures and be maintained as part of procedure history records. Information supporting the justification for the procedure, how procedure bases were developed, and assumptions and informed judgments used to integrate requirements into procedures is maintained with records of the corresponding procedure so that this information may be retrieved. Procedure developers use basis documentation to establish the foundation for procedures. Sets of related procedures might be developed from one group of bases; it is not necessary to have a unique group of bases for each procedure. However, every procedure is tied to the appropriate bases information.

Evidence that the Principle is fulfilled

To fulfill this principle, the procedure process description should describe how procedure development integrates and documents contributing information:

- Management controls basis,
- Standards basis,
- Technical basis,
- Human performance basis,
- Interfaces with related procedures,
- Operating history and lessons learned programs.

Principle 7: Standards are defined for procedure development and design

The organization should define standards for developing and designing procedures. These standards may take the form of institution, facility, or activity documents. Developing procedures consistent with the organization's standards ensures that individual procedures are sound, that the procedure process is coherent, and that documents are controlled and retrievable. The standards should address how all necessary skills, expertise, and experience are captured in the procedure development and review, and the processes for developing and revising procedures. Such standards are often referred to as Procedure Guides.

Multi-discipline skills and knowledge guidelines

Effective procedure development demands full knowledge of the bases and work experience related to a procedure. The organization should develop guidelines for how

the procedure development process will ensure participation of all those needed to provide a thorough knowledge of the work and its hazards and those to perform work and human performance task analyses. This expertise must also involve those involved in the performance and outcome of the work addressed by the procedure. In addition to ensuring this primary expertise, the process must also ensure the development process includes persons knowledgeable about the ISM system, the procedure system, the development and use of bases, and the organization's documentation standards. Further, guidelines should address how participants will be qualified on these related topics.

Development guides

The DOE has issued a DOE Technical Standard for developing technical procedures, DOE-STD-1029-92 "Writers Guide for Technical Procedures." DOE and contractor organizations can use this standard or tailor guides for their specific circumstances. While the Writers Guide is oriented to technical procedures, the basic concepts presented are useful for developing other types of procedures as long as the application of the concepts is based on the nature of the work involved and the skills, knowledge and experience of those who will perform the work. Tailored development guides should define a procedure process, describe guidelines for presenting procedures (content, format, and style) and include a plan for managing the records generated.

Procedure Design guides

The purpose of procedure design is to optimize human performance: (1) by presenting information in ways that are most readily understood by the user, and (2) by presenting information in a manner that reduces or eliminates those errors commonly made during the use of procedures. Procedure design offers methods for eliminating common errors of commission and omission. Design issues include:

- Document Structure
  - Document layout (how to structure the document presentation to increase comprehension and usability)
  - Page layout (how to use headings, white space and typographic techniques to increase performance and quality)
  - Language (how to use terminology, reading levels and sentence structure to enhance understanding and usability)
  - Common error types (knowledge of common errors made when using procedures and strategies for preventing these)
- Use of alternative media to present procedures (e.g., electronic media, paper hard copies),
- Graphical presentations (the use of non-narrative formats such as tables, figures, graphs, and forms) to better articulate required actions and documentation,
- Alternative presentation structures (such as job performance aids) to optimize human performance.

These design concepts, much like the management principles that define the procedures program, are the fundamentals from which the development guides are built.

Evidence that the Principle is fulfilled

To fulfill this principle, the procedure system must include:

- Procedure development standards,
- Procedure process standards,
- Procedure design standards,
- Training and qualification programs for procedure development personnel.

Principle 8: Affected organizations conduct formal reviews of procedures.

Review of procedures by affected organizations (those involved in performing, supporting, or owning the outcome of the work) is important to ensure every aspect of a procedure is technically correct and usable. Any procedure may involve and affect many organizations, each with different responsibilities and expertise. Representatives from these organizations review the procedures from technical, safety, operational, human performance, worker and management perspectives. Involving relevant organizations and individuals for review is equally important for developing new procedures, reviewing infrequently used procedures or revising existing procedures.

Defining the review focus

Although subject matter experts and procedure users develop the bases for a procedure, peer review is essential. Peer review means that the same skills, knowledge and experience mixture is applied to review a procedure as is applied to development of the procedure. Involvement of reviewers should occur as early as possible in the development process.

The procedure review process draws on experts (including procedure users and developers), facilitates the interfaces of the procedure with other activities, and encourages commitment to the process and product. The type and depth of review depends on the procedure content, complexity of the activity, levels of uncertainty, the operational and safety considerations, and the degree of coordination needed among programs and areas of expertise. For example, a procedure for processing hazardous waste streams requires a different set of reviewers and reviews than will a management control procedure on property management.

The procedure process allows for clear definition of which groups review which procedure, disposition of review comments, and documentation of the review in the procedure history file.

Evidence that the Principle is fulfilled

To fulfill this principle, promote the importance of the review process and describe how the organization:

- Develops guidelines to define the review requirements, participants, and expectations,
- Dedicates appropriate resources to support the review effort,
- Provides training for review personnel.

Principle 9: Procedure verification and validation are required prior to use.

A final assessment of the completed procedure is performed by the organization that owns the procedure to ensure the procedure is technically correct, is consistent with operating practices, fulfills the original need for the procedure, and is useable by the intended work force in the intended work environment.

Verification addresses technical accuracy

The line manager responsible for performance of the procedure is responsible for verification. Verification is not intended to replicate the development or review process; verification substantiates the procedure's technical accuracy. To the degree possible, verification is incorporated into the technical review process, but additional actions may be required to ensure that each procedure is of highest quality.

The verification process is intended to ensure:

- The procedure is technically accurate,
- The development and review processes have been conducted consistent with the applicable management controls,
- The procedure is consistent with existing related procedures and consistent with ongoing initiatives,
- The development and review processes have not inadvertently introduced requirements for actions that are inconsistent with contracts and approved operating practices.

Validation addresses procedure usability

A validation is conducted prior to authorization to ensure the procedure can be used as written. This validation focuses on use, a factor that should have already been incorporated in the development phase by subject/technical experts, but which needs reassessment prior to approval. Specifically, the validation allows independent assessment after resolution of review comments to demonstrate that the procedure can be used as written and in the environment where the actual task is to be performed.

For management control procedures affecting general plant or administrative systems, the validation is part of the technical and interdisciplinary reviews conducted of the procedure.

For technical procedures, some level of simulation of the actual practice is used. At the highest level of confidence validation involves use of a mock up or simulator in which the actual steps are practiced. At the next confidence level is a walkdown, in which personnel take the procedure to the location where the task is to be done and, without actually performing the task, ensure that each step is correct and readily useable as written. At the lowest level of confidence, validation is an analytical review that does not simulate actual operation, but validates the procedure based on the knowledge and experience of the reviewers.

Whereas all procedures are validated, the level of confidence needed differs with several factors:

- Type of procedure (management controls, technical procedures or emergency procedures),
- Types of work and the degree of hazard,
- Operating experience or the degree of familiarity with the operation (for example, a small change to a well documented and mature process as contrasted with work involving minimally characterized hazards, high uncertainty or high complexity),
- Successful work experience, including lessons learned materials and other supporting documentation.

First use of a procedure

Irrespective of the validation method used, no procedure is truly validated until it has been used. The procedure system should contain special provisions for first use of procedures based on the risk associated with the work. Procedures that warrant mock-ups, simulator validation or walkdowns should be identified within the procedure system as needing special attention for first use. Such procedures, when authorized after the validation, are identified to let the user know that no one has ever used the procedure before. Therefore, when using a procedure so identified careful scrutiny (possibly including additional observers) is warranted when the procedure is first used.

Infrequent use of a procedure

Infrequently performed work is a major source of accident or injury potential. If a particular work activity has not been performed for some time, the procedure for performing that activity should be reviewed, verified and validated with the same level of rigor as required for a new procedure. During the intervening period of procedure use a number of changes may have occurred. Examples include facility modifications, introduction of new materials in the facility or process, development of new hazards reduction techniques, change in the skills, knowledge and experience of workers or changes in formality of work. These type changes should be identified and resolved through the organization’s change control or configuration management systems. However, the procedure system should contain provisions to identify infrequently used procedures and invoke special infrequent use review.

Evidence that the Principle is fulfilled

To fulfill this principle, establish the criteria associated with verification and validation of each type of procedure and establish a means for identifying the first-use or infrequent use procedures.

Principle 10: Procedure authorization attests to procedure usability and readiness to implement.

The approval process confirms completion of the procedure development phase and establishes accountability and ownership for each procedure. To establish accountability at the proper level, the procedure system should require an approval signature for each procedure. The procedure is generally signed by the person at the lowest level with authority to direct implementation of the procedure. This signature attests that the procedure is technically correct, that workers can understand and use the procedure, that appropriate verification and validation activities have been completed and that the new procedure or a change to an existing procedure has been reviewed for impact on related procedures. Authorization to use a given procedure must be based on a determination that related work would not be adversely affected by implementing the new or revised procedure. (Although the original procedure may be signed, copies issued may not show the signature (as in many electronic systems). Where the signature is not evident, the procedure system must have administrative controls to establish authentication for the copies.

The approval process also should require the approval authority to determine an effective date for implementing the procedure. The approval authority considers the technical and management interfaces as well as the implementing requirements associated with the procedure prior to establishing the effective date. These requirements include, but are not limited to:

- Available resources to implement the requirements of the procedure. Resources include personnel, hardware and associated equipment.
- Status of related procedures. Status includes other procedures under development or revision that interrelate with the procedure to be approved.
- Training needed for workers who will use the procedure. Depending on the complexity of the work and experience and qualification of personnel, training may range from reading the procedure, to reviewing it with supervisors, to formal training.

Evidence that the Principle is fulfilled

To fulfill this principle, establish an approval process that:

- Identifies procedure approval criteria,
- Includes an approval signature for each procedure,
- Defines an approach for determination of the effective date for implementation of the procedure,
- Ensures effective and timely issuance of procedures.

Principle 11: Change control is established for procedures.

A change control process ensures the continued integrity of a procedure. Revision and periodic evaluation of procedures are necessary ongoing processes required to keep procedures current with changes in mission, work, hazards, requirements, systems, personnel or equipment; and to promote procedural adherence.

Revisions to procedures are typically driven by one or more of the following factors:

- Change in the technical basis, requirements, facility configuration, standards, or commitments or other bases;
- Unusual operating conditions and configurations,
- Evaluations, such as user feedback, periodic review, lessons learned, self-assessment, and audits;
- Changes in requirements, commitments, or expectations.

Focused review process

The procedure revision control process balances the need for thorough, disciplined reviews of proposed revisions, with the flexibility to allow timely completion of a revision in order to support the needs of the users. When revisions are made to a procedure, a process should be in place to identify who reviews which type of changes, based on the scope of material changes, the implications, and the affected organizations. As with the initial review process, maintaining the integrity of the procedure system and procedures is dependent on assigning the right resources at the right times.

Expedited revisions

In addition to supporting routine changes introduced as part of regular operations, the revision process also includes an expedited process for reviewing and approving procedure changes whose urgency demands immediate resolution. The ability to modify procedures expediently is key to maintaining the highest standards for worker safety, performance, and responsiveness to changing regulations or commitments.

Periodic review and cancellation

Revisions to procedures are made as necessary; however, the procedure process should contain specific requirements to periodically assess the procedures. Such requirements are established to ensure continued need for the procedure, technical correctness, usability, and compliance with requirements. Organization policy may provide that low risk procedures that are used frequently are "reviewed with use" and do not require separate periodic review. This is only acceptable if the change control process strictly controls the technical basis of the procedure. Procedures that are used infrequently may require a full review prior to use depending on the hazards, complexity and uncertainty associated with the work, irrespective of whether in the interim revisions have been processed to specific sections of the procedure. While the organization may select a variety of review and assessment strategies for various types of procedures, all authorized procedures should have appropriate periodic review.

A process for canceling existing procedures is also established to provide a method for ensuring that procedures that are no longer necessary or no longer used are effectively removed from the system.

Evidence that the Principle is fulfilled

To fulfill this principle, develop change control provisions that:

- Include adequate restrictions to ensure the revision process contributes to maintaining procedure integrity,
- Ensure timely completion of revisions,
- Ensure all affected organizations review the proposed revisions,
- Provide a mechanism for periodic review and cancellation of procedures.

Procedure System Support Principles

A procedure process does not end once a procedure is signed off as approved. Support processes and resources are needed that:

- Make sure procedures are provided in a timely and disciplined manner to the users,
- Maintain and ensure retrievability of records of the procedures development and use,
- Match production resources to the numbers and complexity of procedures generated and to the distribution needs,
- Maintain an effective link between the procedure system and the training program.

Principle 12: A document control and delivery system ensures that the correct and current versions of procedures are available for use.

An important part of the overall procedure system is controlled delivery to ensure that the correct and current version of a procedure is available where and when needed. Control of procedures should be an integral part of an organization's document control system. Several elements are needed to properly control procedure distribution: a procedure index, standardized distribution lists, a method for providing receipted control, and a delivery system commensurate with the volume and types of procedures.

Procedure index

A procedure index lists all approved procedures, listing at a minimum the procedure name, number, and revision. This list is maintained to ensure that the most current version of the procedure is used to perform the task. Because selecting an outdated or superseded procedure is a frequent cause of procedure-related human performance error, the index is not only a basic administrative control but also allows procedure users to locate the correct, current, and approved procedure.

Delivery control system

The delivery control system provides a means to ensure procedures are in place, are made available to procedure users, and the procedure users know where to find them. All procedure presentation types, hard copy, electronic and user aids must be controlled in accordance with procedure system requirements. As appropriate, the delivery system is able to accommodate:

- Procedures to be issued on a routine basis,
- Procedures that require expedited processing,
- Procedures that may require special controls due to inclusion of sensitive, proprietary, or classified information.

Each of these attributes carries specific requirements for reproduction activities, access control, and delivery administration. Therefore, several factors - not only the number of procedures or the number of procedure users - demonstrate why document control is recognized as integral to the overall procedures system.

Delivery lists identify the location where controlled procedures are available. These lists may be structured on a procedure-by-procedure basis or may be grouped in support of the work (for example, by institution, facility or activity). These lists are maintained to ensure that those who use the procedure receive the appropriate procedure and subsequent revisions.

The receipt system - which is often accomplished by written receipts or computer records from electronic distribution - records which version of the procedure has been issued, identifies each controlled copy of a procedure, provides notifications and updates when procedure changes are released, and logs the procedures back -if a mandatory return program is used.

Evidence that the Principle is fulfilled

To fulfill this principle, design and implement a document control program capable of handling the types, number, and volume of procedures. This document control program includes:

- An index of procedures,
- Controlled delivery lists for hard copy or electronic distribution,
- Mechanisms for documenting and monitoring custodial assignments,
- Production and distribution capabilities.

Principle 13: Procedure records are accessible and retrievable

A records program provides the historical counterpart to the document control program. Ready access to the history of proceduralized operations is needed for development of new procedures, revision of existing procedures, procedure reviews and audits. The records program includes access to and retrievability of procedure records, including:

- procedure history files that document the bases and decisions made in the development of the initial procedure and its revisions,
- superseded versions of procedures,
- feedback records generated following use of the procedures,
- periodic reviews.

The procedure system must ensure:

- that procedure files and procedure-generated records such as checklists, forms, and logs, are retained and made part of institution records program.
- that results of periodic procedure reviews and audits are maintained to document that procedures were reviewed for technical accuracy and usability on a regularly scheduled basis.
- that the records program affords a timely and effective means to retrieve superseded procedure revisions and interrelated supporting materials (e.g. bases information). The latter is important because reviews may require support materials, not just the superseded procedure.

Evidence that the Principle is fulfilled

To fulfill this principle, establish a records program that:

- Identifies and collects designated procedure materials as part of the ongoing records program.
- Allows for retention and retrieval of interrelated procedure materials (superseded revisions, development materials) as part of an overall effort to document the historical integrity of operations.
- Ensures personnel are knowledgeable of records requirements and deliver materials to the records program in an appropriate and timely fashion.

Principle 14: Information management resources support the procedure system.

A comprehensive procedure system requires significant information management support. This support includes production capabilities for procedures, integration programs to track commitments and interrelationships among procedures, document control systems, records management for retrieval of support documentation, and distribution capabilities. Therefore, the development and design of the procedures system requires up front acknowledgement, design, and allocation of information management resources.

Among the information management resources needed to support the processing and production of the procedures are:

- Production capabilities to support effective use of development and design principles,
- Production capabilities consistent with the anticipated volumes and to support effective use of development and design principles,

- Information management resources that support tracking of commitments and requirements to ensure agreed to obligations are traceable and visible within the procedure system,
- Identification and tracking of procedure bases documentation to ensure development logic is retrievable as needed,
- Integration of procedures to afford coordinated processing of all procedures affected when a revision or new procedure is introduced,
- Technology assessment and upgrades for other production activities such as printing, distribution, and control of procedures. This support may include distributed processing of a document, multiple distribution centers, on-demand printing, and electronic procedure programs.

During all phases of the document life cycle, it is important that information is available on the status of a document (whether in development, review, revision, etc.), the current version of the document, the availability of the document (for example, where it can be accessed), and who has ownership and custodial responsibility for the document. For these reasons, allocation of appropriate information management support services is a significant contributor to establishing and maintaining an effective procedures program.

Evidence that the Principle is fulfilled

To fulfill this principle, assess the kinds and amount of information management resources needed to operate the procedures system. These resources include support for:

- Procedure production,
- Tracking of commitments, requirements, and procedure bases documentation,
- Document control and records activities,
- Procedure duplication and distribution,
- Continued technology reassessment and upgrades to the procedure management program.

Principle 15: An effective training and qualification program supports the procedure system.

Procedure systems are supported by training and qualification designed to ensure personnel understand the procedure system requirements, and that they are capable of developing, using, and revising procedures.

Managers' training

Managers responsible for the work are trained on:

- the logic of procedure system management requirements,
- when procedures are needed,

- how procedures support ISM and safe and efficient operation,
- how procedures interconnect with other procedures and support management control systems,
- how procedures support management expectations and commitments.

Most importantly, the training emphasizes that procedures, as with systems, equipment and tools, should be owned by managers and workers who are accountable for their proper production and use.

Procedure users' training

The procedure training program shows employees how and when to use procedures and the procedure system including:

- operation by procedure,
- how the procedure process works,
- the employee's obligation in ensuring the integrity of the procedure system.

Training on specific procedures is also provided and training logic and resources (for example, simulators) made available, consistent with objectives of the procedure system.

Procedure developers' training

Procedure developers are trained in performing work and human performance task analyses, developing and documenting the procedure bases, and in the use of writer's guides. Reviewers and validators are trained to understand the procedure system and its relationship to ISM, and to perform appropriate technical and interdisciplinary reviews. Validators are trained to understand the methods of validation and the requirements for validation.

Qualification

In addition to training, the organization should establish provisions to determine that managers, procedure developers, procedure reviewers and procedure users are qualified to perform their responsibilities. Qualification factors include knowledge and experience, the level of supervision involved in assigned tasks and whether assigned tasks will be performed individually or by a team.

Evidence that the Principle is fulfilled

To fulfill this principle, ensure the availability of procedures system training and qualification for:

- Management,
- Procedure users,
- Procedure developers,
- Procedure Reviewers.