RICHLAND OPERATIONS OFFICE

NUCLEAR SAFETY MANAGEMENT MANUAL

John D. Wagoner
Manager

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Revision 0

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1.0 BACKGROUND AND USE OF MANUAL

1.1 SCOPE

The Nuclear Safety Management Manual (NSMM) is intended to provide Richland Operations Office (RL) line management with background and "how-to" guidance for fulfilling RL responsibilities in areas related to Nuclear Safety. The NSMM goal is to apply a consistent strategy at Hanford facilities through management processes that provide cost effective achievement of nuclear safety. The application of these processes result in a management ethic characterized by a disciplined approach to management of operations, sound technical bases for decisions and actions, technical inquisitiveness, and rigorous self-assessment.

The NSMM:

- Is not intended to duplicate or reiterate:
  - requirements,
  - responsibilities and authorities, as presented in the RL Authorities and Responsibilities Manual,
  - standards unless RL policy specifically deviates from the standards;
- Does not assign responsibilities to contractors.
- Is not intended to be a requirements document; however, variance from its guidance must be justifiable and documented.

1.2 APPLICABILITY

This manual applies to management of nuclear facilities and non-facility nuclear operations. Specific applicability is defined in the individual chapters.

Portions of this manual may be applied to non-nuclear facilities. For example, the exemption process addressed by Chapter 14 can be applied to radiological facilities where 10 Code of Federal Regulations (CFR) 834 is applicable.

1.3 EXISTING POLICY

U.S. Department of Energy (DOE) has issued policy statement DOE P 450.2, *Identification, Implementation, and Compliance with Environment, Safety and Health Requirements*. This document establishes the framework for identifying, implementing and complying with environment, safety and health (ES&H) requirements so that work is performed in a manner that assures adequate protection of workers, the public and the environment. The philosophy and approaches presented in this policy statement are utilized throughout this NSMM.

DOE P 450.2 reaffirms the commitments in the Department Nuclear Safety Policy Statement as documented in Secretary of Energy Notice (SEN)-35-91, *Nuclear Safety Policy*, dated September 9, 1991, which states:

"It is the policy of DOE that the general public be protected such that no individual bears significant additional risk to health and safety from the operation of a DOE nuclear facility above the risks to which members of the general population are normally exposed."

SEN-35-91 also provides general expectations and instruction for implementation of this policy, including:

- Management involvement and accountability;
- Development of DOE personnel;
- Development of technical standards necessary to achieve nuclear safety;
- Oversight and self assessment, and;
- Continuous improvement in the nuclear safety culture.

DOE P 410.1, *Developing Nuclear Safety Requirements*, establishes DOE policy to promulgate nuclear safety requirement through the rule making process, including public review and comment. Based on this policy, this NSMM includes procedures and processes for executing RL's responsibilities in meeting nuclear safety rule requirements.

Attachment 1.1 presents a brief background summary of changes in the DOE approach to nuclear safety and regulation of contractors. Evolution of DOE Orders and nuclear safety rules (Price-Anderson Amendments Act of 1988 [PAAA]) is addressed, along with an overview of how various statutes and rules govern nuclear safety.

As the Department replaces Orders with new rules and revised Orders, the resulting transition must be managed to assure adequate protection throughout, while appropriately considering costs and benefits.

It must be noted that even though many ES&H Orders will be canceled as corresponding rules and revised Orders are issued, cancellation of these Orders does not, by itself, modify or otherwise affect any contractual obligation based on the canceled Orders. Requirements in canceled Orders which are incorporated and implemented in a contract will remain in effect until the contract is modified to delete those requirements.

This manual also provides mechanisms to help achieve goals defined in the Hanford Strategic Plan.

1.4 EXPECTATIONS

RL and RL contractors are expected to comply with DOE nuclear safety Orders and Rules as they are applicable to each facility.

DOE issued standards are expected to be used in the development, implementation, review, and approval of related programs and documents. If they are not, the contractor is obligated to identify alternative standards or methods and obtain RL approval prior to their use.

1.5 PROCESS

This manual addresses processes to be applied throughout a facility's (or non-facility activity) life-cycle. Figure 1-1 is a graphical representation of a facility life-cycle, from starting as a new project to decontamination and decommissioning, based on DOE O 430.1, *Life-Cycle Asset Management* (which replaces DOE 4700.1, *Project Management Systems* when contractually imposed on a contractor). The figure includes references to applicable chapters of this manual. Table 1-1 presents a functional/subject cross reference to the appropriate chapters of the manual. These tools should provide quick reference to aid the user in finding the information or process needed for a given situation.

TABLE 1-1

TOPIC/CHAPTER CROSS REFERENCE

TOPIC	CHAPTER
Annual Maintenance and Upgrades	12
Approvals Unreviewed Safety Questions (USQ) Safety Analysis Report (SAR) Exemption Requests Hazard Categorizations Basis for Interim Operations (BIO) Implementation Plans (IPs) Operational Safety Requirements Technical Safety Requirements	8
Authorization Basis	16
BIO (BIO, Interim Safety Basis)	7
Criticality	16
Decontamination and Decommissioning	1,13
Exemption Process	14
Hazard Categorization	4
IP Review and Approval Process	6
New Facilities - Preliminary Safety Analysis Report, etc.	1,3,4,5,8,9,10
Price Anderson Amendments Act of 1988 Background	1
Preliminary Hazards Assessments	5
Regulatory Background	1
Review and Approval Process	8
Risk Guidelines	9
Safety Evaluation Reports (SER)	10
Safety Analysis Process/Safety Basis	3
SAR Review and Approval	8
Surveillance/Transition Facilities	13
USQ	11
Worker Safety	2,3,7,10

ATTACHMENT 1.1

REGULATORY BACKGROUND

1.0 REGULATORY BACKGROUND - ORDERS

The Department of Energy Organization Act, 42 United States Code (USC) 7101 et seq., and the Atomic Energy Act of 1954, as amended, 42 USC 2011 et seq., require the U.S. Department of Energy (DOE) to protect the public health and safety, as well as the safety of workers at DOE facilities, in conducting its nuclear and non-nuclear activities. The DOE promulgated these laws through DOE Orders and Directives to impose requirements and controls on conduct of DOE activities and operations.

In the 1992 time frame, DOE issued a series of new Orders to better define requirements and roles and responsibilities in the areas of safety development, upgrade, and maintenance. Table 1.1-1 presents the dates nuclear safety Orders were issued by DOE and the dates the Orders were contractually imposed on Richland Operations Office (RL) contractors.

Table 1.1-1 DOE Order Issue and Transmittal Dates.

DOE Order	Date DOE Issued the Order	Date RL Transmitted the Order to Contractors for Compliance		
		WHC	PNNL	BHI
5480.21	12/24/91	2/12/92	2/12/92	7/1/94*
5480.22	2/25/92	4/29/92	4/29/92	7/1/94*
5480.23	4/30/92	8/7/92	8/7/92	7/1/94*

DOE 5480.21, *Unreviewed Safety Questions*
DOE 5480.22, *Technical Safety Requirements* (TSR)
DOE 5480.23, *Nuclear Safety Analysis Reports*
*DOE Letter, R. D. Larson to E. M. Keen, 94-END-010

It should be noted that standards supporting these Orders were issued subsequent to contractor submittal of implementation plans in accordance with time frames defined in the Orders. Therefore, the contractor's products (implementation or transition plans and some upgraded safety analysis) submitted to DOE during this time frame often times do not meet the guidance presented in these standards. It is not the intent of this manual to mandate an upgrade of existing safety documents to meet those standards, rather it identifies current

standards that should be used by RL line managers in determining the need for further upgrades in facility safety documentation.

For safety analysis upgrade activities in progress, the following standards provide an acceptable method to demonstrate compliance to the requirements of DOE Orders 5480.22 and 5480.23:

- DOE-EM-STD-5502-94, *Hazard Baseline Documentation*, August 1994.
- DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23, Nuclear Safety Analysis Reports*, December 1992.
- DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Non-Reactor Nuclear Facility Safety Analysis Reports*, July 1994.
- DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (Technical Safety Requirements) and DOE 5480.23 (Safety Analysis Report) Implementation Plans*, August 1994.

2.0 REGULATORY BACKGROUND - PRICE-ANDERSON AMENDMENTS ACT (PAAA)

The PAAA provides indemnification to DOE contractors who manage and operate nuclear facilities in the DOE complex. This indemnification provides an insurance fund from the U.S. Government for any public liability claims that might result from contractor activities within the scope of its contract regardless of fault. In 1988, the PAAA was signed into law to continue and expand the indemnification. As a condition of renewed indemnification and to ensure that contractor performance was consistent with prescribed standards, Congress also mandated a new DOE program, separate and apart from contractual award fees, to subject contractors to civil and criminal penalties for violations of DOE nuclear safety requirements.[1] The PAAA authorizes fines to indemnified contractors (and their suppliers and contractors) of up to $100,000 per occurrence per day (civil penalties are not applicable to DOE employees). In addition, instances of knowing and willful violation can be referred to the Department of Justice for criminal prosecution under Title 18 of the United States Code. Title 10 of the Code of Federal Regulations (CFR), Part 820 permits DOE to initiate appropriate enforcement actions. For reasons of legal due process, civil sanctions can only be applied to violations of laws or regulations that have been promulgated after a public notice and comment period. Promulgated rules are published in the CFR before becoming PAAA enforceable. DOE requirements set forth in Orders and Notices continue to be

[1]Federal Register, Vol. 58, No. 157, Tuesday, August 17, 1993, Rules and Regulations, page 43680.

binding on contractors consistent with the terms and conditions of their contracts, but they are not enforceable under the PAAA.

PAAA does not authorize DOE to enforce violations of requirements within the regulatory jurisdiction of the Department of Labor, Occupational Safety and Health Administration (OSHA), or the Environmental Protection Agency (EPA).[2] The PAAA was enacted to provide broad indemnification coverage for all DOE contractors, subcontractors and suppliers whose activities might result in a public liability claim under PAAA. It stipulated that the indemnification coverage was mandatory to ensure protection of the public from nuclear incidents. This is a provision of the statute, and is not optional on the part of the contractor, or able to be rescinded by DOE - i.e., a contractor, individual facility, or DOE cannot choose whether or not to be indemnified under PAAA. Additionally, the Secretary is required by the statute to extend indemnification through contractual provisions to all contractors, subcontractors and suppliers whose activities might result in a nuclear incident and generate a public liability claim. This involvement is subject to a broad interpretation to protect the public and contractors. Failure to include such provisions by accident or by design does not remove the indemnification afforded by the statute.[3]

However, the rules do provide a process for pursuing exemptions from the rules. Processes and authorities are defined in 10 CFR 820.2 and guidance is provided in DOE-STD-1083-95. The exemption process is addressed in Chapter 14.

Rules are being developed and issued in phases. The following rules have been issued and are in effect as of this writing:

- 10 CFR Part 820, *Procedural Rules for DOE Nuclear Activities; Final Rule*, 58 FR 43680, August 17, 1993, U.S. Department of Energy, Washington D.C.;

- 10 CFR Part 830, *Nuclear Safety Management*, Section 830.120, *Quality Assurance Requirements*, 59 FR 15843, April 5, 1994, U.S. Department of Energy, Washington, D.C.;

- 10 CFR Part 835, *Occupational Radiation Protection*, 58 FR 65458, December 14, 1993, U.S. Department of Energy, Washington D.C.

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[2] Conference paper, Twentieth Annual National Energy and Environmental Quality Division Conference, ASQC, "Transition of DOE to Regulatory Compliance and Enforcement," by Richard L. Black, Director Office of Enforcement, Office of Environment, Safety and Health, U.S. DOE, undated (circa 1994).

[3] Memorandum, from Richard L. Black, Office of Enforcement, to RISG Members (Rule Implementation Steering Group), "Preliminary Responses to Rule Implementation Questions," May 9, 1994.

The balance of phase 1 rules are expected to be published in final form in 1996.

Issuance of 10 CFR 834, Radiation Protection of the Public and the Environment, is also pending. This Rule is generally outside the scope of this manual; however, some chapters, such as Chapter 14 (Exemption Process for PAAA), are generic and can be applied to other Rules.

3.0 REGULATORY BACKGROUND - INTERFACE WITH OTHER SAFETY ACTS/LAWS/RULES

A complex situation exists with respect to jurisdiction (e.g., DOE, OSHA, Nuclear Regulatory Commission [NRC], EPA, and the States) and applicable statutes (e.g., Atomic Energy Act [AEA], OSHA Act, Resource Conservation and Recovery Act of 1976 [RCRA]/Comprehensive Environmental Response, Compensation and Liability Act [CERCLA], and State law), which varies as a function of the type of occupational hazard (physical, chemical, or radiological).[4]

DOE

The DOE assumes jurisdiction over all aspects of worker safety (physical, chemical, and radiological) for contractor and subcontractor employees at facilities authorized under the AEA. DOE contractor and subcontractor employees at facilities not authorized under the AEA (e.g., all non-nuclear facilities, such as the Morgantown and Pittsburgh Energy Technology Centers, the National Renewable Energy Center, and all of the various power administrations) fall under OSHA or OSHA-delegated State jurisdiction. Moreover, DOE Federal employees at all DOE facilities are protected under the OSH Act (29 CFR Part 1960), which requires Federal agencies to maintain OSHA-based occupational safety and health programs, subject to inspection and investigation of worker complaints by OSHA, unless specifically exempted (note that DOE is not exempt). This situation dates from 1974, when the Department of Labor (DOL) granted an exemption to the former AEC under section 4(b)(1) of the OSH Act through an exchange of letters, based on the AEC's authority (section 161(i)(3) of the AEA) to regulate contractor or subcontractor operations at facilities authorized under the AEA. This was formalized by DOL and DOE in a Memorandum of Understanding (MOU) on August 10, 1992, and is implemented under DOE Order 5483.1A, which is intended to specify protection consistent with that required by OSHA in private industry. The MOU also provides DOE access to OSHA expertise and feedback on the adequacy of DOE worker safety and health programs.

[4]Advisory Committee on External Regulation of DOE Nuclear Safety, Task 3: Significant Worker Issues, Working Draft (June 15, 1993).

Inspections for contractor compliance are performed by the DOE Operations Offices, Headquarters Program Offices and the Office of Environment, Safety, and Health (EH). For DOE operations not exempted from the OSH Act, inspections may be performed by OSHA or through an authorized state program. If violations are identified that involve Federal employees, a citation goes to DOE that identifies the alleged violation, specifies the abatement date, but includes no fine. If the violation involves DOE contractor personnel, a similar citation goes directly to the contractor, but it includes a proposed civil penalty. When a contractor is cited, negotiations to achieve closure are carried out between the contractor and OSHA or the State.

In May, 1993, the Secretary of Energy announced that DOE would immediately begin the process of shifting, within a period of 3 to 5 years, from partial internal oversight of occupational safety and health to entirely external enforcement by OSHA. DOE and DOL are in the final stages of concluding an MOU that provides DOE funding for an independent group to "...explore, identify, and develop strategies to facilitate a seamless transition from internal DOE oversight to external OSHA enforcement of occupational health and safety" at DOE AEA-authorized contractor facilities. In addition to examining the current DOE programs and initiatives, the study will identify a transition schedule and resources required by OSHA to assume transferred regulatory and enforcement authority.

In October, 1994, DOE initiated a Voluntary Protection Program (VPP) for its contractors, modelled after the OSHA VPP for private industry. This program relieves facilities with exemplary worker protection programs from routine inspections and decreases regulatory oversight onsite inspection (and therefore resource) requirements. One DOE facility (Waste Isolation Pilot Project) has qualified [as of the date of footnote 4], and about half of all DOE contractors have applications in process. DOE also recently became the first government member of the VPP Participants Association, a consortium of about 240 private sector VPP programs.

In December, 1994, DOE and DOL concluded an MOU governing worker protection at DOE's gaseous diffusion plants leased to the United States Enrichment Corporation prior to their being "certified" by the NRC. This agreement gives OSHA the responsibility for physical and chemical hazards, and shares the responsibility for radiological hazards. After NRC certification, this shared responsibility for radiological hazards will shift exclusively to the NRC (see the description of worker regulation at NRC licensed facilities below).

Environmental Protection Agency

EPA's current involvement in worker protection (aside from its regulatory functions under the Toxic Substances Control Act, and worker standards functions for radiological emergency response) are limited to its cleanup and remedial action responsibilities under CERCLA/RCRA. Conformance to OSHA safety standards is required for all cleanup and

corrective operations at sites carried out under CERCLA or RCRA, as well as hazardous waste operations at sites designated by State or local authorities and emergency response to fires, explosions, and chemical accidents. CERCLA required the development of specific standards for cleanup workers by OSHA; these are codified at 29 CFR Part 1910.120. The U.S. Environmental Protection Agency (EPA) has also codified these requirements (40 CFR Part 311) for application to workers in situations that are not under OSHA jurisdiction (e.g., State and local employees). EPA carries out its site safety inspections jointly with OSHA at RCRA/CERCLA sites. EPA trains its personnel at OSHA's training institute, and has a continuing agreement to fund the costs of OSHA's own participation in RCA/CERCLA activities.

Nuclear Regulatory Commission

Like DOE, the NRC claims exemption, in its regulation of licensees, from the OSH Act on the basis of section 161(i)(3) of the AEA. Although the NRC exemption is less complete -- it does not include physical and chemical safety, but only where there is no actual or potential interaction with AEA materials --, as a consequence of its wide scope there is essentially no OSHA presence at NRC licensee sites. In recent years NRC has recognized the need to pay greater attention to physical and chemical safety, and has sent a few of its inspectors to OSHA's training institute. NRC inspectors maintain a much greater presence at licensee sites, especially those that involve power reactors and fuel cycle facilities, than is the case for OSHA inspectors. NRC penalties for non-compliance must be approved at the level of the Executive Director of the NRC.

Occupational Safety and Health Administration

OSHA compliance activities are based on infrequent (compared to NRC) programmed inspections and responses to worker complaints; the Agency does not have sufficient resources to conduct routine inspections on any more than an infrequent basis (i.e., much less than annually). For this reason OSHA has been reluctant to assume oversight responsibility for DOE workers. OSHA has a comprehensive set of criteria for physical and chemical safety (including cleanup operations) that provides the basis for health and safety of workers nationwide. However, OSHA currently lacks inspectors trained in radiation hazards, and its outdated radiological safety criteria need revision to bring them into conformance with Federal radiation protection guidance.

2.0 INTEGRATED SAFETY MANAGEMENT

[RESERVED]

3.0 MANAGEMENT OF SAFETY ANALYSIS REPORT (SAR)/ TECHNICAL SAFETY REQUIREMENTS (TSR)/ BASIS FOR INTERIM OPERATIONS (BIO) DEVELOPMENT

3.1 SCOPE

This chapter identifies existing U.S. Department of Energy (DOE) policy and expectations for managing development of nuclear facility nuclear safety authorization basis documentation such as SARs, TSRs, and BIOs/Interim Safety Basis.

Nuclear Safety Authorization Basis (NSAB) documentation is required to be submitted to DOE as part of the contractor's implementation plan for coming into compliance with DOE Orders 5480.23 and 5480.22, and will be required by 10 CFR 830.110 (SARs) and 10 CFR 830.320 (TSRs). The Richland Operations Office (RL) review and approval process for implementation plans is described in Chapter 6.0.

3.2 APPLICABILITY

This chapter is applicable to the development of NSAB documentation for nuclear facilities and non-facility nuclear operations as defined in DOE 5480.23.

3.3 EXISTING POLICY

3.3.1 Existing Requirements

a. DOE 5480.23, *Safety Analysis Reports.*

b. DOE 5480.22, *Technical Safety Requirements.*

c. 10 CFR 820, *Procedural Rules for DOE Nuclear Activities.*

d. 10 CFR 830, *Nuclear Safety Management.*

3.3.2 Existing Guidance

a. DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23*, is expected to be used to categorize nuclear facilities (see chapter 5, *The Hazard Categorization Process*).

b. DOE-STD-3011-94, *Guidance for Preparation of DOE 5480. 22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*, is expected to be used as guidance to develop BIOs submitted to RL.

3.4 EXPECTATIONS

Facility NSAB documentation is expected to present an accurate assessment of facility hazards, resulting risks, and related controls. This is required to:

- Allow DOE to determine acceptability of the risk and liability posed by the facility; and

- Provide DOE a basis by which Hanford facility risks can be prioritized to support risk-based management decisions.

Current contractor Implementation Plans (IP) for a specific facility define the existing NSAB documentation and provide plans and schedules for proposed upgrades. The IP commitments are expected to be funded by the current Fiscal Year Work Plan (FYWP) and/or programmed into the Multi-Year Program Plan (MYPP).

An integrated schedule for NSAB document development, upgrade and maintenance should be requested from the contractors to establish a basis for resources and staffing both within the contractor and in RL. This schedule needs to be modified to reflect approved MYPPs and FYWPs.

a. Prior to contractor development or upgrade of Nuclear Safety Authorization Basis documentation, RL and the contractor should establish a plan that:

   - Defines the scope & applicability of the document. This includes definition of buildings, and significant systems, structures and components. This also includes definition of proposed missions.

   - Establishes the acceptance criteria for the document. This includes how the DOE directives and standards will be used during review and approval activities.

   - Establishes assumptions & models for accident analyses. This includes planned activities, boundaries, computer codes, risk guidelines, etc.

b. RL should identify the Designated Approval Authority and the kinds of reviews (see Chapter 8.0) that will be used for review and approval activities.

c. A detailed integrated schedule for the document development, upgrade or maintenance activity can then be established and all team members briefed. This briefing should cover the plan, schedule, issue resolution, and other ancillary needs such as work locations, staffing, computer hardware & software requirements, and essential points of contact. DOE needs for preparation of the SER should be provided for.

3.5 PROCESS

Figure 3.5 provides an overview of the safety analysis process throughout a facility life-cycle, including upgrading existing safety documentation under DOE 5480.23.

3.5.1 Importance of Safety Document Development

The importance of having a well thought out process for development of safety documents can be seen from Figure 3.1. This shows the relationship between document development and the opportunity to ensure safety either inherently or extrinsically. The importance of increasing inherent safety versus adopting measures to impose extrinsic safety are two fold. First, over the life of the facility the cost is much lower to design in inherently safe structures, systems, and processes than to apply labor intensive administrative controls that must be maintained over the life of the facility. Secondly, the overall safety of the facility is enhanced through inherently safe design. Structures and components have a much higher reliability than human actions. Overall, the quality of the facility's basic design is much more critical in providing for safe operations than safety features and administrative controls added later to minimize the risks. The aim should be to eliminate the risk through design rather than apply additional process controls. An effective process risk management strategy tries to place greater emphasis in the following decreasing order: Inherent design of process, facility design and passive barriers, active barriers and safety equipment, and procedural controls.

3.5.2 SAR Preparation Process; New Facilities

This section covers the process of preparing a SAR. It includes the interaction of safety analyses activities with engineering designs under the auspices of program management. The Program Manager must have a thorough comprehension of the steps and the process through which a SAR is prepared. This comprehension is necessary to understand and manage the development of the SAR.

Figure 3.2 indicates a process for preparing a SAR and its relationship with design analysis activities for a proposed project. It is the key to understanding how a SAR is developed. However, the various tasks and documents described in the first three columns in the figure are presented as examples and are for illustrative purposes only. Actual tasks and documents may differ for specific projects. Although these differences are expected to occur, the process of preparing a SAR (as modeled in Figure 3.2) remains the acceptable method of task performance and documentation that conforms to DOE's safety analysis policies. The figure also shows the corresponding safety analysis document for each stage in design through to operation.

Figure 3.2 shows that the SAR preparation activities are part of the overall project activities, including the actual report preparation (as illustrated in the last column of the figure).

Therefore, the program line management should have total responsibility for the organization, performance and monitoring of SAR preparation efforts.

The project and the program management may want to assign a separate safety analysis manager for larger or complex projects. The safety analysis manager should: 1) plan and schedule the safety analysis report reviews, 2) organize and assemble the SAR review team, 3) advise the program regarding all anticipated safety issues, and 4) ensure incorporation of funding needs for reviews into the MYPP.

Typical safety analysis activities conducted throughout the various project life-cycle phases are represented in the first column of Figure 3.2. These activities are matched with the parallel project design activities described in the second column. Together they generate a set of typical project documents, described in the third column. Relevant information and data from the project documents then is abstracted and complied to produce the SAR.

Figure 3.2 shows that a major task of the SAR is to record the activities performed by the project to meet mandated safety objectives.

The presentation of this safety information in the SAR is organized in a manner shown in Figure 3.3.

3.5.3 Safety Analysis and Design Are Iterative Processes

As shown in Figure 3.2, safety analysis and its documentation is synonymous with the SAR preparation process. It must be an integral part of the project design efforts. These events are shown in the first three columns. This task can be accomplished only through an iterative process.

Typical project tasks that should be performed jointly by safety analysis and design engineers to complement each other are shown in Figure 3.4.

The SAR preparation process steps, shown in Figure 3.4, essentially coincide with the activities conducted in the normal course of project design. And, as Figure 3.2 shows, a major portion of those activities are performed by the project to meet mandated safety objectives.

3.5.4 Safety Reevaluation and Safety Analysis Documentation (Re-baselining) of Existing Facility

Previous sections primarily presented guidance to conduct safety analyses and prepare SARs for proposed new projects or facilities. A different approach is necessary to conduct and document the safety reevaluation of existing facilities with a new mission or to develop a DOE 5480.23 compliant SAR. This section provides guidance specific to the following differences: 1) performance of safety reevaluation, or re-baselining an existing facility, and

2) preparation of the reevaluation documentation. That documentation could be a revision of the existing safety analysis documentation or a separate, new SAR.

It should be noted that this is not the same activity as creating a BIO document. Refer to Chapter 7 for further information.

DOE policy requires demonstration of reasonable assurance that nuclear facility operations are conducted in a manner that poses no significant increase in risk to the health and safety of the public and workers, or to the environment. The objectives of reevaluating existing facilities are to:

- Assess the adequacy of the facility's design bases and operating envelope; and
- Provide a technical basis against which future design or operation changes can be measured.

The project re-baselining effort is accomplished by performing a facility safety audit, the objectives of which are to:

- Assure that facility designs meet current DOE requirements.
- Determine if the probabilities and consequences of potential accidents represent an acceptable level of risk.
- Identify the scope of further information needed (deterministic analysis and risk assessment that is warranted).
- Assure that the conduct of operations would foster safe operation at the facility.
- Support emergency preparedness activities.
- Identify preventive and mitigative actions to control hazards and initiating events.

The facility safety audit consists of the following major tasks:

- Assessment of the existing facility design for compliance with DOE design criteria.
- Safety analysis reevaluation.
- Operational safety evaluation.

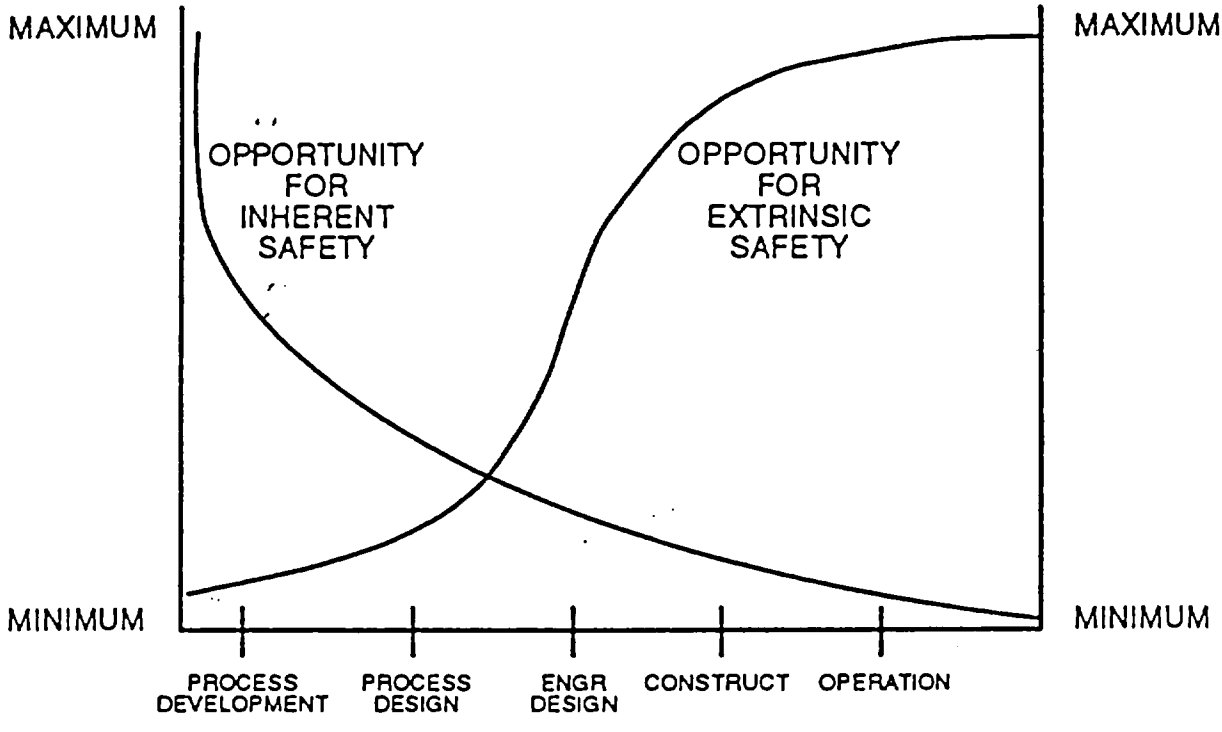
Based on the conclusions of the reevaluation, corrective action recommendations are developed that include design changes, upgrades, modifications or additions, and changes needed in the conduct of facility operation. Implementation of these corrective action recommendations by the project results in satisfying the facility re-baselining objectives.

All the analyses performed in the safety audit evaluations (their results, safety issue resolutions, as well as corrective action recommendations and implementation) shall be documented in the SAR. The documented output of this task should be one of the following:

- A facility safety audit and reevaluation report.
- An update and revision of existing SAR documentation.
- A new SAR.

As can be seen the major difference between development of the SAR for a new facility versus an existing facility focuses on the facilities design basis. Reconstruction of the design basis should be performed if possible and as required to verify adequacy of existing safety structures, systems, and components to prevent or mitigate accidents.

Figure 3.1 - Effects of Timing of Design Changes



DEPARTMENT OF ENERGY
NUCLEAR MATERIALS STABILIZATION TASK GROUP
DNFSB Recommendation 94-1 Implementation Plan Milestones
As of February 29, 1996

NMSTG Milestone Number	NMSTG Material Group	DOE Site	Milestone	Due Date	Finish Date
IP-3.6-101	SNF	SR	Re-examine L-Basin corrosion surveillance coupons.	Feb 1995	Feb 1995
IP-3.4-001	Spec Iso	SR	Immediately discontinue F-Canyon water cooling of Am/Cm solutions.	Feb 1995	Feb 1995
IP-3.4-003	Spec Iso	SR	Implement surveillance and monitoring programs to reduce the risk of extended storage of special isotope	None	Mar 1995
IP-3.4-015	Spec Iso	SR	Start vitrification of Am/Cm Solutions.	Mar 1998	
IP-3.4-016	Spec Iso	SR	Complete Am/Cm solutions vitrification.	Sep 1998	
IP-3.4-017	Spec Iso	SR	Begin stabilization of Pu-242 Solutions at HB-Line, Phase III.	May 1997	
IP-3.4-018	Spec Iso	SR	Complete stabilization of Pu-242 Solutions at HB-Line, Phase III.	Nov 1997	
IP-3.4-019	Spec Iso	SR	Begin stabilization of Np-237 Solutions HB-Line, Phase II.	Jul 2001	
IP-3.4-020	Spec Iso	SR	Complete stabilization of Np-237 Solutions at HB-Line, Phase II.	Dec 2002	
IP-3.4-021	Spec Iso	SR	Transport inadequately stored Pu-238 solids to HB-Line for venting and repackaging.	Apr 1995	Mar 1995
IP-ES-008	Spec Iso	SR	Conceptual design report for the stabilization of Am/Cm Solutions completed.	Dec 1995	Nov 1995
IP-3.5-002	Uranium	SR	Complete FA-Line blending and processing of 230,000 liters of HEU solutions into a stable oxide.	Dec 1997	
IP-3.5-008	Uranium	SR	Complete construction of blending facilities at F- and H-Areas (HEU Dilution Project).	Jul 1996	

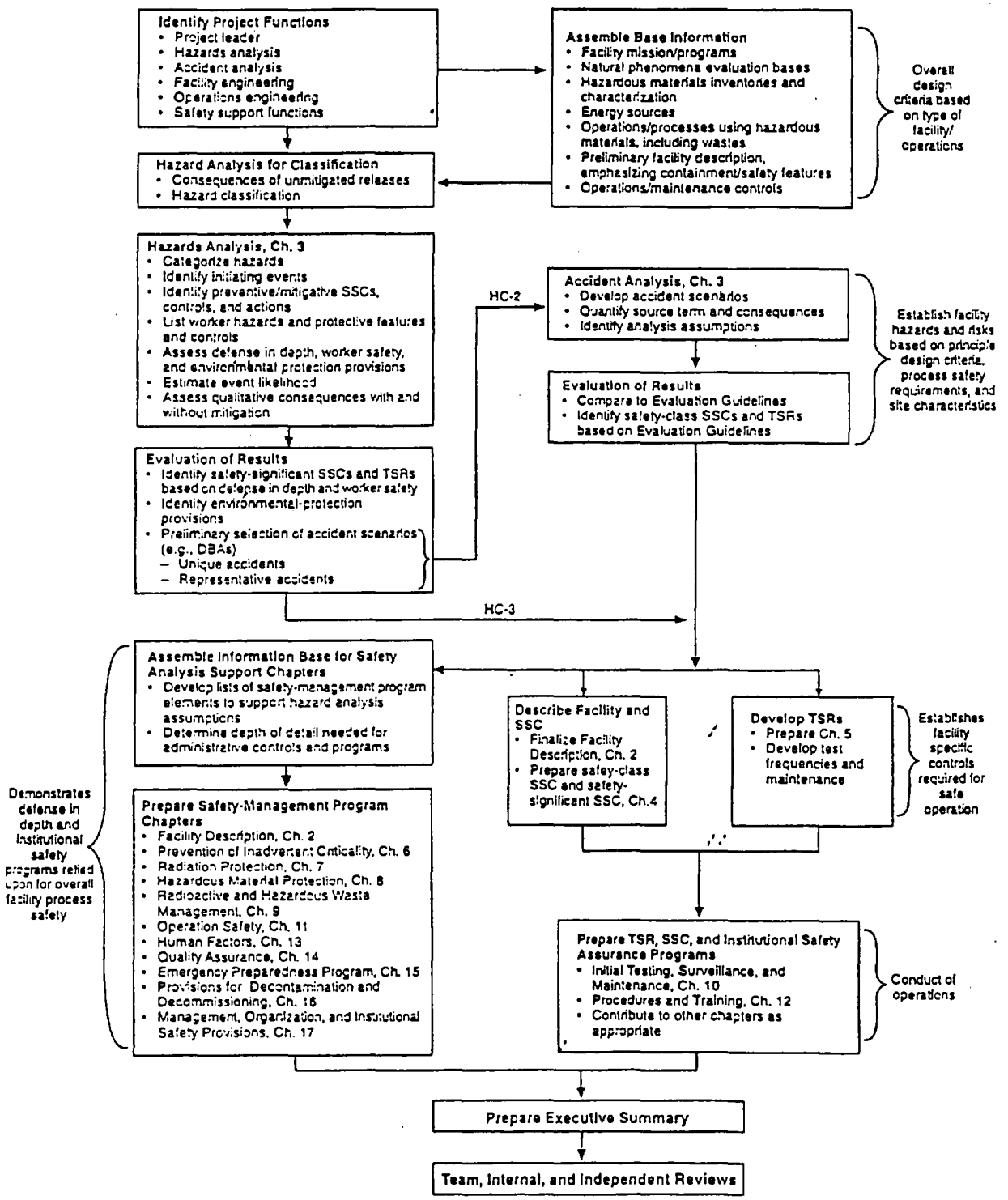

Identify Project Functions
• Project leader
• Hazards analysis
• Accident analysis
• Facility engineering
• Operations engineering
• Safety support functions
Assemble Base Information
• Facility mission/programs
• Natural phenomena evaluation bases
• Hazardous materials inventories and characterization
• Energy sources
• Operations/processes using hazardous materials, including wastes
• Preliminary facility description, emphasizing containment/safety features
• Operations/maintenance controls
Overall design criteria based on type of facility/ operations
Hazard Analysis for Classification
• Consequences of unmitigated releases
• Hazard classification
Hazards Analysis, Ch. 3
• Categorize hazards
• Identify initiating events
• Identify preventive/mitigative SSCs, controls, and actions
• List worker hazards and protective features and controls
• Assess defense in depth, worker safety, and environmental protection provisions
• Estimate event likelihood
• Assess qualitative consequences with and without mitigation
HC-2
Accident Analysis, Ch. 3
• Develop accident scenarios
• Quantify source term and consequences
• Identify analysis assumptions
Evaluation of Results
• Compare to Evaluation Guidelines
• Identify safety-class SSCs and TSRs based on Evaluation Guidelines
Establish facility hazards and risks based on principle design criteria, process safety requirements, and site characteristics
Evaluation of Results
• Identify safety-significant SSCs and TSRs based on defense in depth and worker safety
• Identify environmental-protection provisions
• Preliminary selection of accident scenarios (e.g., DBAs)
– Unique accidents
– Representative accidents
HC-3
Assemble Information Base for Safety Analysis Support Chapters
• Develop lists of safety-management program elements to support hazard analysis assumptions
• Determine depth of detail needed for administrative controls and programs
Describe Facility and SSC
• Finalize Facility Description, Ch. 2
• Prepare safety-class SSC and safety-significant SSC, Ch.4
Develop TSRs
• Prepare Ch. 5
• Develop test frequencies and maintenance
Establishes facility specific controls required for safe operation
Demonstrates defense in depth and institutional safety programs relied upon for overall facility process safety
Prepare Safety-Management Program Chapters
• Facility Description, Ch. 2
• Prevention of Inadvertent Criticality, Ch. 6
• Radiation Protection, Ch. 7
• Hazardous Material Protection, Ch. 8
• Radioactive and Hazardous Waste Management, Ch. 9
• Operation Safety, Ch. 11
• Human Factors, Ch. 13
• Quality Assurance, Ch. 14
• Emergency Preparedness Program, Ch. 15
• Provisions for Decontamination and Decommissioning, Ch. 16
• Management, Organization, and Institutional Safety Provisions, Ch. 17
Prepare TSR, SSC, and Institutional Safety Assurance Programs
• Initial Testing, Surveillance, and Maintenance, Ch. 10
• Procedures and Training, Ch. 12
• Contributs to other chapters as appropriate
Conduct of operations
Prepare Executive Summary
Team, Internal, and Independent Reviews

Figure 3.3

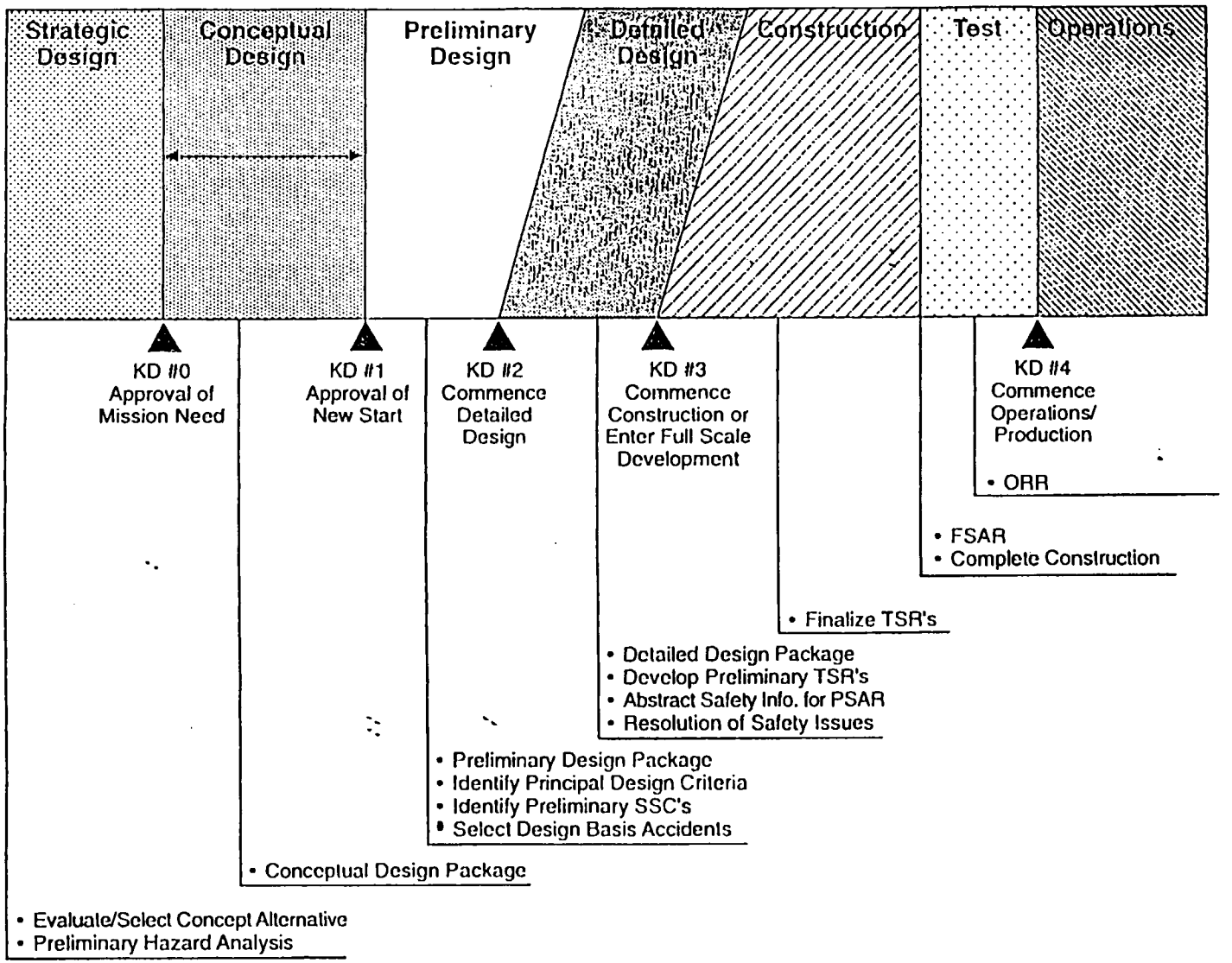
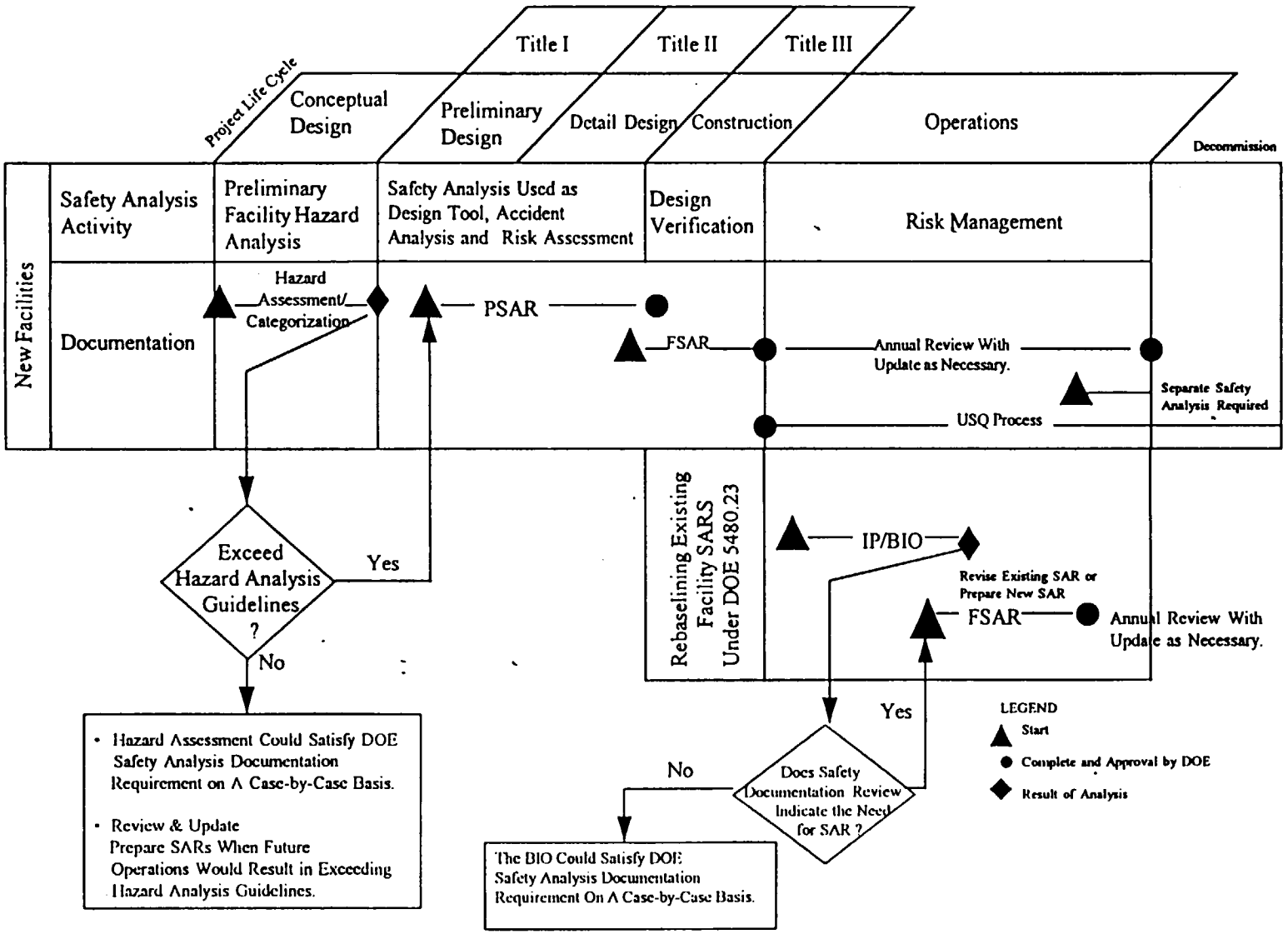

Strategic Design
Conceptual Design
Preliminary Design
Detailed Design
Construction
Test
Operations
KD #0 Approval of Mission Need
KD #1 Approval of New Start
KD #2 Commence Detailed Design
KD #3 Commence Construction or Enter Full Scale Development
KD #4 Commence Operations/ Production
• ORR
• FSAR
• Complete Construction
• Finalize TSR's
• Detailed Design Package
• Develop Preliminary TSR's
• Abstract Safety Info. for PSAR
• Resolution of Safety Issues
• Preliminary Design Package
• Identify Principal Design Criteria
• Identify Preliminary SSC's
• Select Design Basis Accidents
• Conceptual Design Package
• Evaluate/Select Concept Alternative
• Preliminary Hazard Analysis

Figure 3.4

Figuer 3.5


Title I
Title II
Title III
Project Life Cycle
Conceptual Design
Preliminary Design
Detail Design
Construction
Operations
Decommission
New Facilities
Safety Analysis Activity
Preliminary Facility Hazard Analysis
Safety Analysis Used as Design Tool, Accident Analysis and Risk Assessment
Design Verification
Risk Management
Documentation
Hazard Assessment/ Categorization
PSAR
FSAR
Annual Review With Update as Necessary.
Separate Safety Analysis Required
USQ Process
Exceed Hazard Analysis Guidelines ?
Yes
No
Rebaselining Existing Facility SARS Under DOE 5480.23
IP/BIO
Revise Existing SAR or Prepare New SAR
FSAR
Annual Review With Update as Necessary.
Yes
No
Does Safety Documentation Review Indicate the Need for SAR ?
LEGEND
Start
Complete and Approval by DOE
Result of Analysis
• Hazard Assessment Could Satisfy DOE Safety Analysis Documentation Requirement on A Case-by-Case Basis.
• Review & Update Prepare SARs When Future Operations Would Result in Exceeding Hazard Analysis Guidelines.
The BIO Could Satisfy DOE Safety Analysis Documentation Requirement On A Case-by-Case Basis.

4.0 HAZARD CATEGORIZATION

4.1 SCOPE

Formal hazard categorization of facilities and/or activities are required to be performed by DOE 5480.23, *Nuclear Safety Analysis Reports (SAR)*, and must be included as part of the SAR. The intent of performing a hazard categorization is to determine if a nuclear safety analysis report compliant with DOE 5480.23 is required for the facility or activity. If a SAR is required, the hazard categorization is a factor to consider in determining the sophistication of analysis and thoroughness of documentation to be provided in the SAR. All Richland Operations Office (RL) facilities, with the exception of administrative support buildings, should be categorized.

4.2 APPLICABILITY

Hazard categorization of nuclear facilities applies to all RL facilities containing any radionuclides and includes their entire life cycle. DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, clearly states that it is to be used with DOE 5480.23 and may not be applicable to other DOE Orders. Therefore, hazard categorization using this DOE Standard determines the applicability of DOE 5480.21, 5480.22 and 5480.23 for the facility or activity under consideration. Due to this specific limitation, facility or activity hazard categorization under DOE-STD-1027-92 should not be considered by itself as a basis for determining the applicability or nonapplicability of any other requirements, including other nuclear safety Orders.

4.3 EXISTING POLICY

4.3.1 Existing Requirements

a. DOE 5480.23, *Nuclear Safety Analysis Reports*. This Order provides the requirement to perform a hazard analysis and categorization of a nuclear facility.

4.3.2 Existing Guidance

a. DOE-EM-STD-5502-94, *Hazard Baseline Documentation*. This is a limited technical standard establishing uniform guidance on hazard baseline documents that identify and control radiological and non-radiological hazards for all Environmental Management facilities.

b. DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports.* This standard a uniform method to be used for determining if a nuclear safety analysis report is required, and if a SAR is required, identification of Hazard Category 1, 2 or 3 nuclear facilities. This standard also provides guidance on the use of graded approach and hazard/accident analysis techniques for compliance with DOE 5480.23.

4.4 EXPECTATIONS

4.4.1 Facility or Activity Hazard Analysis and Categorization

Nuclear facilities as presented within DOE 5480.23 includes both reactor and nonreactor nuclear facilities. The Order defines a nonreactor nuclear facility as those activities or operations that involve radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to the employees or the general public. This includes activities or operations that: (1) produce, process, or store radioactive liquid or solid waste, fissionable materials, or tritium; (2) conduct separations operations; (3) conduct irradiated materials inspection, fuel fabrication, decontamination, or recovery operations; (4) conduct fuel enrichment operations; or (5) perform environmental remediation or waste management activities involving radioactive materials.

The evaluation required under DOE-STD-1027-92 for a nuclear facility is performed through an assessment based upon the hazardous material inventory contained within the boundaries of the facility or activity being considered. In establishing this inventory, the contractor should ensure that inventories expected to be encountered in facility operations are enveloped.

DOE 5480.23 states that contractors shall be required to perform a hazard analysis of their nuclear activities and classify their processes, operations, or activities. The SAR should include a recognition and indicator of severity for each major type of hazard (radiological, chemical, etc.) at the facility, as well as an overall facility hazard classification.

Both an initial and final hazard categorization are addressed in DOE-STD-1027-92. A preliminary hazard assessment is performed during the existing SAR upgrade or new SAR preparation planning activity to provide an early estimate of the hazard categorization for the facility or activity. This assessment requires only that minimal effort required to identify the inventory of hazardous material. An initial hazard categorization for the facility or activity is generated using this inventory estimate. The initial hazard categorization is used to assess whether prior facility hazard classifications may need to be changed and provides a basis both for planning the SAR upgrade/preparation project and for prioritizing SAR upgrade activities.

Upon completion of the hazard analysis required to be performed under DOE 5480.23 the final hazard categorization for a facility or activity can be established. The final hazard categorization is based on the credible unmitigated release of hazardous material as developed in the hazard analysis. For purposes of hazard categorization, this determination is meant to consider material quantity, form, location, dispersibility and interaction with available energy sources. It may also consider passive barriers such as building structures but not active safety features such as filters, heating, ventilating, and air conditioning systems, fire suppression, etc. Applying these considerations to the hazard analysis may reduce the releasable amount of hazardous material, resulting in identifying that a different categorization is appropriate. If that analysis shows the energy sources and process contributing to the generation of uncontrolled release of hazardous materials results in no potential for significant localized consequences the facility may be categorized as other than a nuclear facility (i.e., below a category 3 nuclear facility). If the hazard analysis supports a different release fraction than that used for the derivation of Category 2 values, in Table A.1 of DOE-STD-1027-92, those Category 2 threshold inventory values may be modified as discussed in the Standard. This may cause a facility or activity that was previously designated as a Hazard Category 2 to be redesignated as a Hazard Category 3.

DOE has used the EPA model identified in 40 CFR 302.4, Appendix B, to calculate threshold quantities for Category 3. If approved by RL, the contractor may use that model directly to calculate threshold values. When using that methodology the analysis must be consistent with the EPA model, include all credible pathways, and be technically defensible. The resulting analysis and categorization must be reviewed and approved by RL following the process identified for Safety Analyses in Chapter 8 of this manual. When the EPA model is not applicable due to the source term distribution the use of an alternative model may be used if it is technically defensible and pre-approved by DOE.

4.4.2 Facility or Activity Segmentation

During the hazard categorization process flexibility is allowed in the definition of facility or activity segments when establishing hazardous material inventories to be considered. The objective of the hazard analysis required to be performed by DOE 5480.23 is to understand the hazards available within a facility or activity that could interact and cause harm to individuals or the environment. Providing an estimate of potential consequences associated with the total inventory of hazardous materials within a facility or activity when the features of the facility or activity preclude bringing this material together during credible postulated event sequences could be considered overly conservative. It is not the intent of the safety analysis process to result in the unnecessary imposition of excessive requirements on simple or even trivial operations just because they happen to be located within the boundary of a facility or activity.

Therefore, DOE-STD-1027-92 allows the facility or activity to be segmented where features prevent bringing hazardous materials together or preclude harmful interaction of material as a result of common severe accident phenomena. A technical basis that clearly demonstrates the assumed independence of systems or inventory areas must be provided to support segmentation of the facility or activity.

4.4.3 Inventory Exemption

Under DOE-STD-1027-92 a certain portion of the hazardous material inventory contained within the boundary of a facility or activity may be excluded from consideration during the hazard categorization process. Sealed radioactive sources that have been engineered to pass special form testing may be excluded from consideration if the facility has documentation that validates satisfactory testing and if a compliant source control program has been implemented. Hazardous materials present in exempted, commercially available products or contained in Department of Transportation (DOT Type B shipping containers may be excluded from consideration.

4.4.3 Reevaluation of the Hazard Categorization

Facilities and activities that are undergoing modifications in systems, process or mission that could result in changes to the basis supporting the original hazard assessment and categorization will require reevaluation under the Unreviewed Safety Question or SAR update procedures. This revision of the final Hazard Categorization may conclude that the facility or activity hazard categorization decreases or increases. A facility or activity that had previously been designated as nuclear or non-nuclear under DOE-STD-1027-92 may be allowed redesignation as non-nuclear or may require redesignation as nuclear, respectively.

4.5 PROCESS

DOE 5480.23 requires that a preliminary hazard assessment be prepared and submitted by the contractor because the hazard classification influences the requirements for length and thoroughness of SAR. The preliminary hazard assessment indicates an estimate of the hazard categorization for the facility or activity for use by both DOE and contractor line management in planning and scheduling both SAR upgrade and initial SAR preparation activities. The preliminary hazard assessment should be reviewed upon submittal by DOE program line management. The scope of the review should be sufficient to validate the accuracy of the hazard categorization estimate. Results of this review should be retained in the administrative record for the facility authorization basis.

The final hazard categorization and supporting analysis is usually contained within the SAR for the facility or activity. In this case, review and approval of the hazard categorization by DOE line management will be incorporated in the SAR review process. If the hazard categorization and supporting hazard assessment is submitted as a document outside of a SAR, this document will be reviewed and approved by DOE line management using the

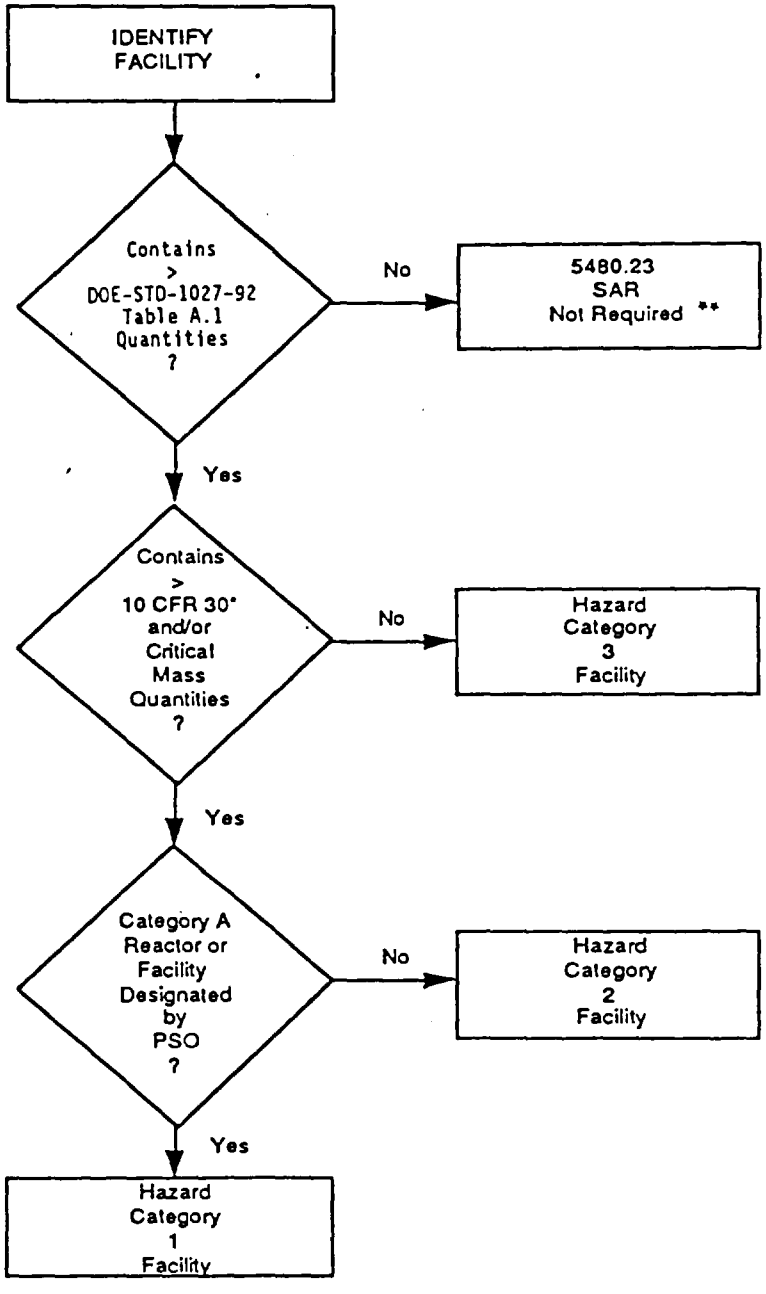
process outlined in Chapter 8. The facility hazard assessment and categorization document will be maintained as part of the facility or activity authorization basis (see DOE 5480.21).

As previously mentioned, when reviewing a facilities hazard categorization the reviewer should follow the process described in Chapter 8, for both initial and final hazard categorization. The categorization shall indicate the criteria used, facility segmentation if any, credit taken for sealed sources and DOT type B shipping containers, estimate of total inventory and method of determining it, passive barriers credited (active barriers or mitigation can not be credited), and a comparison to threshold quantities.

Figure 4.1 presents the general process for facility or activity hazard categorization.

Figure 4.1

HAZARD CLASSIFICATION DECISION PROCESS



* As modified in Attachment 1 of DOE-STD-1027-92
** DOE-EM-STD-5502-94 provides additional classification criteria for EM nonnuclear facilities.

5.0 HAZARD ANALYSIS

5.1 SCOPE

This chapter identifies existing U.S. Department of Energy (DOE) policy and expectations related to hazard analysis. Although hazard analyses are performed in support of various programs intended to protect people, facilities, and the environment, this chapter will focus on hazard analysis related to the nuclear safety aspects of DOE facilities and activities.

5.2 APPLICABILITY

This chapter is applicable to all nuclear facilities as defined in Chapter 4.

Hazard analysis forms the basic building block for the entire safety analysis effort, including specifically addressing defense in depth and protection of workers and the environment. Hazard analyses evaluate the significance of hazardous situations associated with a process or activity through use of qualitative and quantitative techniques to pinpoint weaknesses in the design and operation of facilities that could lead to accidents.

For the purposes of this procedure, hazard analysis includes:

- Identification of hazards without regard for the likelihood or credibility of accident scenarios or consequence mitigation. Hazard means a source of danger. This could be a material, energy source, or operation with the potential to cause illness, injury, or death to personnel or damage to a facility or to the environment.

- Evaluation of initiating events which, when associated with a hazard, could cause an accident.

- Qualitative estimation of the frequency and consequences of postulated accidents.

The hazard analysis provides the information needed to identify scenarios requiring more detailed accident analysis during the safety analysis process.

5.3 EXISTING POLICY

5.3.1 Existing Requirements

a. DOE 5480.23, *Safety Analysis Reports (SAR)*. "It is the policy of the Department that nuclear facilities and operations be analyzed to identify all hazards and potential accidents associated with the facility and the process systems, components, equipment, or structures and to establish design and operational means to mitigate these hazards and potential accidents..."

5.3.2 Existing Guidance

a. DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23.* Provides guidance for conducting hazard evaluations and provides radiological threshold values for determining the hazard category of a facility.

b. DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports.* Provides guidance for the preparation of hazard and accident analyses as the primary component of the safety analysis report to ensure compliance with DOE 5480.23.

c. DOE-EM-STD-5502-94, *Hazard Baseline Documentation.* Provides a road map to the safety and health hazard identification and control requirements contained in Orders and provides Environmental Management guidance on the applicability and integration of these requirements. This includes a definition of four classes of facilities (nuclear, non-nuclear, radiological, and other industrial facilities), thresholds for facility hazard classification, and the identification of required safety and health hazard identification and control documentation.

5.3.3 Existing External Guidance

a. 29 CFR 1910, *Process Safety Management of Highly Hazardous Chemicals.*

b. *Guidelines* for Engineering Design for Process Safety, American Institute of Chemical Engineers, New York, NY, 1993

c. *Guidelines* for Hazard Evaluation Procedures, American Institute of Chemical Engineers, New York, NY, 1992

5.4 EXPECTATION

Attachment 1 provides background information related to hazard evaluation approaches and techniques.

The hazard analysis technique applied to a given facility should be appropriate for the type and complexity of the subject facility or activity. Considerations include project life cycle (new facility, existing, etc.); the facility hazard categorization (see Chapter 4) which provides the primary indicator of the magnitude of radiological hazards; the complexity of the facility and its processes. See Attachment 1 for techniques available. The contractor should provide the rationale justifying the choice of technique(s). For example, an existing facility or process designed with several levels of protection using redundant controls and safety systems requires a hazard evaluation technique that will identify and evaluate a variety of potential accident event sequences. Less complex facilities and process systems can be evaluated with simpler techniques.

The hazard analysis must address the current (and possibly expected) mission of the facility. A facility near the end of its mission, that is partially shut down, or is providing only limited functions, need not develop a hazard analysis to the depth and detail of a facility whose mission may be extended in the future.

The hazard analysis must demonstrate that a disciplined, systematic approach was used in performance of the hazard analysis. More than one technique may be used in concert to provide the necessary depth or breadth needed for the analysis.

The hazard analysis must highlight assumptions made in performing the analysis. Hazard analyses, because of their highly subjective nature, are difficult to duplicate by independent experts. Even with application of sophisticated techniques, the performance of a high quality hazard analysis is still largely dependent on good judgment. The subtle assumptions that hazard analysts and process experts necessarily make while performing the hazard analysis can often be the driving force behind the results.

For the same reasons cited above, supporting documentation should be available (but not part of the SAR) identifying the individuals and credentials involved in performing the hazard analysis. To a large extent, DOE must accept that the quality and completeness of the hazard analysis is dependant on the hazard analysis team and the techniques used.

Hazard analysis includes assignment of qualitative frequencies of postulated accidents involving identified hazards. Although most hazard evaluation techniques are intended to be brief and are based on judgement, scenarios determined to be incredible that are removed from further consideration in the safety analysis, should have documented justification for the "incredible" frequency determination.

Whenever possible, operating experience should be used to supplement the hazard identification process. Problems that have occurred demonstrate where hazards exist. However, basing hazard identification solely upon experience is never fully satisfactory because many hazards may be overlooked. Good experience may only demonstrate that the hazards have been adequately controlled, not that hazards do not exist. Assuming that something cannot happen simply because it has not happened is not an acceptable approach to hazard identification.

The hazard identification and evaluation process is self grading. As described above, selection of appropriate hazard analysis techniques must be based on the general nature of the facility. However, artificial grading or limitations must not be applied at the hazard identification and evaluation stages of safety analysis since the hazard analysis forms the basic building block for the entire safety analysis effort.

Many of the hazard analysis techniques presume that accurate facility descriptions and drawings (especially Process and Identification Drawings) exist. If a technique is applied to a facility with inaccurate or suspect drawings and related information, hazard analysis documentation is expected to acknowledge this situation and identify measures taken to accommodate the lack of reference documents (e.g., performance of facilities walkdowns to verify information, etc.).

5.5 PROCESS

None applicable.

ATTACHMENT 1

HAZARD ANALYSIS TECHNIQUES

In safety analysis, the initial analytical effort for all facilities is a hazard analysis that systematically identifies facility hazards and accident potentials through hazard identification and hazard evaluation. The focus of the hazard analysis is on thoroughness and requires evaluation of the complete spectrum of hazards and accidents. This largely qualitative effort forms basis for the entire safety analysis effort, including specifically addressing defense in depth and protection of workers and the environment.

Basic industrial methods for hazard analysis, interface with more structured quantitative evaluations, and the basis for both have been described in references such as the American Institute of Chemical Engineers *Guidelines for Hazard Evaluation Procedures*. These guidelines have been accepted by Occupational Safety and Health Administration (OSHA) as the standard for analytical adequacy in characterizing commercial chemical processes that perform the same type of unit operations conducted at DOE nonreactor nuclear facilities. Appropriately applied, they help fulfill the requirements of Safety Analysis Reports for Hazard Category 2 and 3 facilities as specified in DOE 5480.23.

The largely qualitative techniques described in the above reference provide methodologies for comprehensive definition of the accident spectrum for workers and the public. The basic identification of hazards inherent in the process provides a broad, initial basis for identification of safety programs needed (e.g., radiation protection, hazardous chemical protection). The hazard analysis then moves beyond basic hazard identification to evaluation of the expected consequences and estimation of likelihood of accidents.

Following are typical hazard identification and evaluation techniques from the reference cited above. The techniques are grouped here according to general hazard evaluation circumstances which loosely correspond to the life cycle of a facility or activity. However, it may be appropriate to use these techniques (or combinations of techniques) in situations other than presented here. Figure A-1 presents a matrix showing the general applicability of these techniques.

DESIGN (early during the life of a process). These are efficient techniques for taking a "broad-brush" look at the inherent hazards of a large plant or complex process.

Safety Review - Safety Reviews (also known as Process Safety Reviews, Design Reviews, or Loss Prevention Reviews) are intended to identify plant conditions or operating procedures that could lead to an accident and result in injuries, significant property damage, or environmental impacts. When performed on existing facilities the Safety Review typically involves a walk-through inspection that can vary from an informal, routine visual examination to a formal examination performed by a team that takes several weeks. The Safety Review technique is often used to perform a prestartup safety review of a process or activity.

Checklist Analysis - A Checklist Analysis uses a written list of items or procedural steps to verify the status of a system. A detailed checklist provides the basis for a standard evaluation of process hazards. Generic hazard checklists are often combined with other hazard evaluation techniques to evaluate hazardous situations. Traditional checklists are used primarily to ensure that organizations are complying with standard practices.

Relative Ranking - Relative Ranking is actually an analysis strategy rather than a single, well-defined analysis method. This strategy allows hazard analysts to compare the attributes of several processes or activities to determine whether they possess hazardous characteristics that are significant enough to warrant further study. Relative Ranking can also be used to compare several process siting, generic design, or equipment layout operations, and provide information concerning which alternative appears to be the "best" (least hazardous) option. These comparisons are based on numerical values that represent the relative level of significance that the analyst gives to each hazard. Relative Ranking studies should normally be performed early in the life of a process, before the detailed design is completed, or early in the development of an existing facility's hazard analysis program.

Preliminary Hazards Analysis (PHA) - A PHA yields a qualitative description of the hazards related to a process design. A PHA also provides a qualitative ranking of hazardous situations that can be used to prioritize recommendations for reducing or eliminating hazards in subsequent phases of the life cycle of the process. A PHA can be performed by one or two people who have a process safety background. Less-experienced staff can perform a PHA, but the study may not be as exhaustive or as detailed, since this approach requires that analysts use a significant amount of judgment.

What-If Analysis - The What-If Analysis technique is a brainstorming approach in which a group of experienced people familiar with the subject process ask questions or voice concerns about possible undesired events. It is not as inherently structured as some other techniques (e.g., Hazard and Operability Analysis and Failure Modes [HAZOP] and Effects Analysis [FEMA]). The purpose of a What-If Analysis is to identify hazards, hazardous situations, or specific accident events that could produce an undesirable consequence. An experienced group of people identifies possible accident situations, their consequences, and existing safeguards, then suggests alternatives for risk reduction. This is a powerful technique if the staff is experienced). Otherwise, the results are likely to be incomplete.

DESIGN AND ROUTINE OPERATION

What-If/Checklist Analysis: Combines both techniques, as described previously to provide both power of the what-if analysis and the completeness of the checklist analysis.

HAZOP Analysis - HAZOP is a structured method of systematically investigating each element of a system for all the ways in which important parameters can deviate from the intended design conditions to create hazards and operability problems. The hazard and operability problems are typically determined by a study of the piping and instrument diagrams (P&ID) by a team of personnel who critically analyze effects of potential problems arising in each function of the operation. The main elements of HAZOP include determining

(1) the hazards which exist in a unit or are associated with a process, (2) the effects associated with the hazard (e.g., safety, environmental, economic), (3) the occurrence of accidents, and (4) the measures to prevent a hazard from occurring or to mitigate the effects of an accident or failure.

HAZOP Analyses are conducted by an interdisciplinary team of individuals (i.e., individuals knowledgeable of the process, instrumentation, and operator). An experienced team leader systematically guides the team through the plant design using a fixed set of "key words." Pertinent key words are selected, (e.g., flow, temperature, pressure, and time). Then the effect of deviations from design or normal conditions of each parameter is examined. The system is evaluated as designed and with deviations noted. All causes of failure are identified. An assessment is made weighing the consequences, causes, and protection requirements involved.

Generally, HAZOP should be used for identifying accident scenarios associated with continuous processing which involves the control of a significant number of parameters in order to maintain the process in steady-state conditions and within safe limits. Such processes generally have systems intended to monitor key parameters. Such systems may interface with automatic control and protection systems which act to maintain the process in a safe condition or may only trigger alarms to alert the operator that a parameter change requires a response. Thus, such a process can be either one that is automatically controlled and generally expected to operate with a minimum of supervision, or one requiring intense operator involvement for control. For this reason, detailed design information (e.g., P&IDs) is required for the analysis.

FMEA - The FMEA is a methodical study of potential component failures. This review starts with a diagram of the operation and includes all components that could fail and conceivably affect the safety of the operation. Typical examples are instrument transmitters, controllers, valves, pumps, and rotometers. These components are tabulated and individually analyzed for the following:

- Potential mode of failure;
- Consequences of the failure, effect on other components, and effect on whole system;
- Probability of failure;
- Detection methods; and
- Compensating provisions.

Multiple concurrent failures are also included in the analysis. The last step is to analyze the data for each component failure or multiple component failure and develop a series of recommendations appropriate to risk management.

FMEA is bottom-up approach that looks at the failure of each element of a system or process and identifies the consequences of each failure. FMEA is most appropriate for analysis of small segments of a system or process when it is determined that failure of single components in this segment could lead to system or process failure of release of material.

FMEA has some limitations which must be recognized to ensure its appropriate use. First, FMEA is not very efficient for large-scale systems analysis because, by virtue of its bottom-up approach, it examines and documents the effects of component failures having little, if

any, relevance to system failure or potential release. Second, FMEA is strictly equipment-oriented. It looks at failures of equipment and assesses their consequences by does not look at failures of a process, which, by its very nature, may have complexities and instabilities far beyond those which can be assessed only by examining the failure of individual components.

SPECIFIC HAZARDOUS SITUATIONS OF CONCERN - These techniques require more specialized expertise to apply and should be used on tightly focused problems since they require significantly more time and effort to perform than do the more broad-brush approaches.

Fault Tree (FT) Analysis - A FT analysis can be either a qualitative or a quantitative model of all undesirable outcomes which could result from a specific initiating event. It begins with a graphic representation (using logic symbols) of all possible sequences of events that could result in an accident. The resulting diagram looks like a tree with many branches, each branch listing the sequential events (failures) for different independent paths to the top event. Probabilities (using failure rate data) are assigned to each event and then used to calculate the probability of occurrence of the undesired event. FT analysis is a top down approach for systematic assessment of various ways by which an undesirable event can occur.

Since a FT analysis starts form an undesirable event and logically identifies basic fault conditions which can contribute to its propagation, only those faults contributing to an undesired outcome are modeled. This process is much more efficient than bottom-up approaches such as FMEA and is the main reason for its wide spread use. FT analysis is most suitable for analysis of large, moderately complex systems or processes where multiple component failures including human errors can contribute to the failure of the system or process.

This technique is particularly useful in evaluating the effects of alternative actions on reducing the probability of occurrence of the undesired event.

Event Tree Analysis - An ET analysis can be either a qualitative or a quantitative model of undesirable events such as an uncontrolled release of hazardous material from a facility, either radioactive or chemical material or both. ET is a simple approach to delineating sequences of events which could lead to the undesired event. In the ET analysis, for each initiating event, various systems or barriers designed to prevent the occurrence of the undesired event or to mitigate the progress of the accident are identified. At each event tree heading, the success or failure of these systems or barriers is graphically shown. The result is a pictorial representation of various combinations of systems or barriers which succeed or fail to prevent the occurrence of an undesired event or to achieve a final safe condition. ET analysis is most helpful for delineation of sequences of mitigation of the progression of the accident. Examples of such sequences include fire scenarios or seismic events. In such cases, the combination of various barrier successes and failures is best represented by using ET analysis.

Integrated ET and FT Techniques - Connecting the initiating event and ET and FT models in a structured fashion is a proven technique capable of handling, in an efficient and comprehensive fashion, the very complex nature of the system designs, interactions, and dependencies prevalent in complex processes. A large part of the reason for selecting this technique is that the nature of the hazard is straightforward, but its possible causes are numerous. For example, insufficient cooling to the reactor core leads to the release of large quantities of radionuclides from the core, but the causes of loss of coolant are many and intricate. Thus, the emphasis on systems is a key benefit for evaluating these complex processes. Further, because the integrated nature of the complex processes results in a large number of intricate combinations of failures which can lead to a release, the probabilities approach used is essential in determining which of these combinations is necessary to consider in addressing consequences, for the sheer number of them makes the use of engineering judgement more complicated and less reliable.

For highly complex facilities with multi-component control systems and extensive redundancy, the extensive use of Event Trees (ET) and Fault Trees (FT) is needed to understand the potential release mechanisms. The specification of the use of these techniques is due to the complex system interdependencies found in such facilities. ET/FT techniques are capable of clarifying these interdependencies. The ET/FT technique involves defining initiating events leading to process disturbance and constructing detailed ET and FT models to represent plant response to various accident conditions resulting from those disturbances. These techniques have been proven to be especially useful in evaluating processes involving very complex systems with high levels of integration and interdependency.

Cause-Consequence Analysis - A Cause-Consequence Analysis (CCA) is a blend of Fault Tree and Event Tree Analyses. A major strength of a CCA is its use as a communication tool: the cause-consequence diagram displays the relationships between the accident outcomes (consequences) and their basic causes. This technique is most commonly used when the failure logic of the analyzed accidents is rather simple, since the graphical form can become quite detailed.

Human Reliability Analysis - A Human Reliability Analysis (HRA) is a systematic evaluation of the factors that influence the performance of operators, maintenance, staff, technicians, and other plant personnel. A HRA will identify error-likely situations that can cause or lead to accidents. A HRA can also be used to trace the causes of human errors. HRA is usually performed in conjunction with other hazard evaluation techniques. Refer to Chapter 16, Human Factors for further uses of an HRA.

FIGURE A-1 TYPICAL USES FOR HAZARD ANALYSIS TECHNIQUES[5]

	Safety Review	Checklist	Relative Ranking	PHA	What-If	What-If/ Checklist	HAZOP	FMEA	FT	ET	CCA	HRA
R&D			X	X	X							
Conceptual Design		X	X	X	X	X						
Pilot Plant Operation		X		X	X	X	X	X	X	X	X	X
Detailed Engineering		X		X	X	X	X	X	X	X	X	X
Construction/Start-Up	X	X			X	X						X
Routine Operation	X	X			X	X	X	X	X	X	X	X
Expansion or Modification	X	X	X	X	X	X	X	X	X	X	X	X
Incident Investigation					X		X	X	X	X	X	X
Decommissioning	X	X			X	X						

Legend: Shaded areas denote techniques typically seen in Hanford facilities' safety analysis.

PHA - Preliminary Hazards Analysis
HAZOP - Hazard and Operability Analysis
FMEA - Failure Modes and Effects Analysis
FT - Fault Tree
ET - Event Tree
CCA - Cause-Consequence Analysis
HRA - Human Reliability Analysis

[5]Center for Chemical Process Safety of the American Institute of Chemical Engineers, *Guidelines for Hazard Evaluation Procedures Second Edition with Worked Examples*, American Institute of Chemical Engineers, New York, NY, 1992, page 77.

6.0 IMPLEMENTATION PLAN REVIEW AND APPROVAL

6.1 SCOPE

Contractors are required to submit implementation plans to the U.S. Department of Energy (DOE) that address incorporation of nuclear safety requirements presented in Rules, Orders, Notices, Immediate Action Directives and Manuals (DOE requirement documents). Because review and approval of the plans will often involve multiple Departmental organizations, the review and approval process must provide for coordination, consistency of review, and resolution of issues among those offices. In addition, the review and approval process must address both the technical adequacy of the proposed implementation plans and the programmatic responsibilities. This chapter will discuss this framework for review and approval of Implementation Plans.

6.2 APPLICABILITY

This chapter is intended for use by all DOE organizations when reviewing and approving implementation plans for DOE nuclear safety requirements. The following guidance has been developed to support this process.

6.3 EXISTING POLICY

6.3.1 Existing Requirements

a. DOE 5480.22, *Technical Safety Requirements*

b. DOE 5480.23, *Safety Analysis Reports*

c. 10 CFR 820, Part II Department of Energy, *Procedural Rules for DOE Nuclear Activities*; Final Rule, 58 FR 43680, August 17, 1993, U.S. Department of Energy, Washington D.C.

6.3.2 Existing Guidance

a. DOE-STD-1082-94, *Preparation, Review, and Approval of Implementation Plans for Nuclear Safety Requirements*, October 1994.

b. DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*, August 1994.

6.4 EXPECTATIONS

Implementation Plan Approval - DOE approval of the implementation plan constitutes acceptance that:

- The proposed activities represent an acceptable method to meet the requirements;

- The resources identified in the plan are necessary and sufficient to ensure completion of the activities contained in the plan and are expected to be available to support the proposed schedules;

- The proposed milestones and schedules are acceptable;

- The applicability of the requirements are correctly identified; and

- The identified compensatory actions are acceptable.

Exemptions - Exemptions are to be requested whenever relief is sought from the applicable DOE requirement. The implementation plan shall clearly identify any exemptions that have been approved or are being requested from the subject requirements. Implementing organizations may submit requirements for exemptions as part of the implementation plan provided that they relate to the same requirements.

Requests for exemption that are submitted as part of the implementation plan shall be identified in the implementation plan summary for early recognition. Early identification of exemption requests is important because they may need to follow a separate review and approval process.

The provisions for requesting and granting exemptions to rules are stated in 10 CFR Part 820, Subpart E, "Exemption-Relief." All exemptions to rules must be approved by the Secretarial Officer designated in 10 CFR Part 820, Subpart E notwithstanding the level of approval delegated for the implementation plan. The provisions for granting exemptions to Orders, Notices, Immediate Action Directives and Manuals are specified in the directives documents.

Extensions to the Submittal Schedule for Implementation Plans - An implementing organization may request an extension to the time allowed to prepare and submit an implementation plan through the Quality, Safety, and Health Programs Division (QSH). QSH will coordinate the approval or rejection of an extension request with the appropriate Departmental Cognizant Secretarial Officers (CSOs) . Requests for extension shall be submitted within sufficient time for DOE to review and approve the extension before the original due date. Extensions will be granted only for good cause, such as the complexity of the plan or the impact of multiple plans on an implementing organization's resources. Such requests should be drafted as narrowly as possible to permit timely compliance with as many nuclear safety requirements as possible.

An exemption is required to extend any schedule mandated in the DOE requirements documents unless specific provisions for schedular relief are provided.

6.5 PROCESS

The following descriptions are taken from DOE-STD-1082-94 and are repeated here for convenience.

Rule Implementation Steering Group - A Department Rule Implementation Steering Group (RISG) will provide oversight for the process and ensure consistency in the review and approval efforts across all nuclear safety rule requirements. The RISG will resolve issues which are generic to the rule implementation plan process.

Implementation Working Group - For each DOE requirements document (or group of DOE requirements documents, if appropriate) an Implementation Working Group will be formed to provide oversight and coordination of implementation plan reviews for the specific DOE requirements document. The Working Groups shall ensure consistency in the review process across the DOE complex, monitor review progress, and resolve any issues related to the review and approval process. The Working Group leader shall be designated by the RISG for plans developed to meet the nuclear safety rules. For plans developed to meet other nuclear safety requirements the Working Group leaders shall be determined by the CSOs or their designees. The Working Groups shall provide assistance to the Review Team Leaders to ensure that each team has adequate programmatic and technical capabilities. The Working Groups shall ensure that an Implementation Plan Guide (technical and program guidance) is established to do the following: (1) ensure consistent implementation plans across the DOE complex; (2) facilitate identification of specific reviewers and schedule development; and (3) review implementation status through the entire review and approval process.

Points-of-Contacts - Each Operations Office Manager shall identify a point-of-contact for each DOE requirements document to the RISG. The Operations Office point-of-contact shall be the primary interface with the implementing organization for all activities associated with the development, submittal, review, and approval of the implementation plans. The Operations Office point-of-contact shall also be the Review Team Leader. Any exception to the point-of-contact as the Review Team Leader shall be approved by the Working Group. The Review Team Leader shall coordinate assignment of Review Team Members with the CSOs and the Operations Office through the Working Group. The Operations Office Manager may also designate an office coordinator for nuclear safety requirements activities.

Implementation Plan Review Team (IPRT) - As discussed in the pervious paragraph, the Operations Office point-of-contact shall normally be the Review Team Leader. The Operations Office Manager may provide additional team members and technical assistance as necessary and agreed by the Working Group. In addition, each affected CSO shall identify the Program Office representatives for each Review Team to the Review Team Leaders through the Working Group. The CSO may assign multiple reviewers to a single site or a single reviewer.

Implementation Plan Review Team Leader - The IPRT leader is the RL individual designated as the RL point-of-contact, and also acts as the RL Review Team Leader.

General Review Approval Process - The review and approval process must be sufficiently flexible to accommodate a wide variety of subjects addressed by the DOE requirements documents and yet be adequately structured to permit efficient completion of the review and approval within the schedule specified in the DOE requirements document (typically 90 to 180 days).

7.0 BASIS FOR INTERIM OPERATION (BIO)

7.1 SCOPE

This chapter identifies existing DOE policy and expectations for a facility BIO and provides guidance for RL review of contractor BIOs.

The contractor plans for implementing DOE 5480.23, *Nuclear Safety Analysis Reports (SARs),* and 5480.22, *Technical Safety Requirements (TSRs),* are required to contain the "bases for interim operation or restrictions on interim operations" until the existing safety basis documentation is upgraded to SARs and TSRs. In some cases the BIO will function as the SAR for the remaining life of the facility.

The RL review and approval process for Implementation Plans (IPs) is described in Chapter 6, *Implementation Plan Review and Approval.*

7.2 APPLICABILITY

BIO's are required for nuclear facilities and non-facility nuclear operations as defined in Chapter 4, "Hazard Categorization Process," with the two following exceptions:

a. If the facility currently has a DOE approved SAR that meets DOE 5480.23 requirements, or

b. An exemption is granted (see Chapter 14, Exemption Process).

The Interim Safety Basis (ISB) as used by some Hanford operating contractors is intended to be equivalent to a BIO.

7.3 EXISTING POLICY

7.3.1 Existing Requirements

a. DOE 5480.23, *Safety Analysis Reports.*

b. DOE 5480.22, *Technical Safety Requirements.*

7.3.2 Existing Guidance

a. DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23.*

b. DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans.*

c. DOE-STD-1082-94, *Preparation, Review, and Approval of Implementation Plans for Nuclear Safety Requirements.*

7.4 EXPECTATIONS

Contractor BIOs are expected to present an accurate assessment of facility hazards, resulting risks, and related controls in order to:

a. Allow DOE to determine acceptability of the risk and liability posed by the facility, and

b. To provide DOE a basis on which to prioritize Hanford facility risks and to support risk-based management decisions.

If a DOE 5480.23 SAR is not to be developed (e.g., the BIO is deemed adequate to serve as the safety basis for the facilities), then an exemption request must be submitted by the contractor and processed by RL and HQ (See Chapter 14, *Exemption Processes*).

If a facility does have a defined mission (i.e., is in an "operating" mode), and the existing safety documentation requires upgrade to the requirements of DOE 5480.23, but submitted schedules indicate a significant period before upgrades are completed (i.e., more one year), then a full BIO in accordance with DOE-STD-3011-94 is expected.

The level of detail presented in a BIO is dependent upon a number of factors such as hazard categorization, complexity, and stage of life cycle of the facility. For more discussion of the graded approach philosophy see Chapter 16.B.

Upon approval of the contractor IP and attendant BIOs, the IP, BIOs, related OSR/TSR, and basis documents cited therein will constitute the nuclear safety authorization basis of the related nuclear facilities and will be subject to the Unreviewed Safety Question process (see Chapter 11).

Note that if a facility chooses to depend on a BIO as its authorization basis, the facility must continue application of the USQ process until the facility is no longer categorized as a nuclear facility (see Chapter 4).

BIOs are expected to address each topic specified in DOE-STD-3011-94, even if only to say that the topic does not apply with a brief basis for the statement. Table 7.1 presents an outline of DOE-STD-3011-94 which can be used as a checklist for RL review purposes.

Implementation Plans are <u>not</u> expected to include upgraded safety analysis or SARs for new facilities. Only BIOs (which are expected to reference existing safety analyses documents, such as SARs, ISBs, etc.), or commitments to upgraded SARs are expected to be presented in IPs. If a contractor is prepared to submit an upgraded SAR concurrent with submittal of the IP, the IP should identify submittal of the upgraded SAR as part of the plan and schedule. This expectation is based on the fact that if an upgraded SAR is submitted as part of the IP/BIO, the 180-day approval time frame mandated by DOE 5480.23 and 10 CFR 830 will apply to review and approval of the upgraded SAR.

Interim controls identified by a contractor in the IP/BIO must be implemented. For example, a commitment to monitor pressure is unacceptable if the means to measure the pressure does not exist.

Hazard Analysis (HA) - IP/BIO are expected to include a HA for each nuclear facility. The HA is expected to provide a broad picture of differences between existing analysis and current facility activities and mission. The HA supports the BIO and determination of whether interim controls are needed.

- If the contractor determines that existing analysis cited by the BIO includes an adequate HA, a new HA is not expected.

- If changes have occurred (processes, mission, etc.) and are not reflected in analysis cited by the BIO, a new HA is expected. The contractor is obligated to make a USQ determination and handle accordingly (See Chapter 11).

BIOs can be used to delete existing controls (i.e., OSRs) if the controls are no longer applicable to a facility's mission or mode (e.g., extended surveillance and maintenance). It is expected that proposed deletion of controls will be technically justified and documented in the BIO. See Chapter 8 for expectations of safety documentation justifying elimination of existing controls.

7.5 PROCESS

See Chapter 6 for Implementation Plan review and approval process.

See Chapter 8 for review and approval process applicable to BIO's.

Table 7-1 CONTENT OF BIO PER DOE-STD-3011-94

a. Executive Summary

- o Results of safety analysis summarized.
- o Facility hazard classification identified.
- o Safety assurance programs discussed.
- o Vulnerabilities identified.
- o Compensatory measures discussed.
- o Restrictions on interim operations identified.
- o Operational history, current and future missions.
- o Rationale of why facility is safe
- o Based on life cycle/mission extent of analysis performed is justified.

b. Introduction

- o Background of facility.
- o Current mission.
- o Contribution to site mission.
- o Past relevant operating history.
- o Status of existing authorization basis and needed revisions to support current mission.
  - reference existing SA/OSR documents
  - summarize those analyses, controls, and assumptions
  - check that this matches Safety Analyses done.

c. Facility Description (to develop understanding of how facility operates)

- o Facility description.
- o Designed mission.
- o Designed processes.
- o Structures, systems, or components important to safety (those given credit in safety analysis)

d. Relevant Operational History

- o Significant abnormal occurrences/accidents described; review Occurrence Notification Center.
- o Description of compensatory measures planned or implemented.
- o Safety-related changes after DOE operation authorization or last update to safety documents summarized.
- o Significant safety related findings from Operational Readiness Review's/audits described.

e. Safety Management (only few sentences with reference to control source documents)

- o Radioactive/Hazardous Waste Management
- o Criticality Protection
- o Radiation Protection
- o Hazardous Material Protection
- o Training
- o Testing
- o Surveillances
- o Maintenance
- o Conduct of Operations
- o Configuration Management
- o Quality Assurance

o Decontamination and Decommissioning

o Review of Experiments

o Emergency Preparedness

f. Safety Envelope (focus on facility workers, onsite workers, and public)

o facility safety envelope is discussed/referenced to include:

- OSR's--safety limits, operation limits, surveillances
- operational restrictions
- administrative controls

o Assessment of adequacy based on concepts in DOE 5480.23 (look at existing Preliminary Hazards Analysis (PHA), safety analysis, accident scenario).

- analysis of adequacy of existing safety documents.
- identify inadequacies that will be addressed in BIO.
- identify inadequacies that won't be addressed in BIO.
- justify not addressing inadequacies based on safety.

o OSR document identified.

o Date of last major update of OSR document identified.

o Guide used for existing OSR's or restrictions identified.

o Does discussion focus on safety envelope of dominant scenarios.

o Does discussion detail the safeguards and how they're preserved.

o Safeguards must show:

- safety function
- gradation of safety systems
- operability requirements
- procedures
- surveillances
- OSR

- o Additional safeguards considered significant to facility safety.
- o Assumptions made on system functions and operator actions needed for safety are explicitly identified.
- o Referenced OSR's or equivalent submitted with BIO.
- o Maximum radiological and toxicological inventory identified.

g. Safety Analysis

- o Approach for hazard identification discussed/referenced .
- o Approach for hazard classification discussed/referenced.
- o Facility hazards identified. A PHA at minimum using worksheets and facility walkdown.
- o Analytical methods and results identified.
- o Impact of accidents analyzed on facility & on-site workers, public, and environment discussed. (environment is only addressed in absence of human receptors)
- o Dominant credible accident scenarios identified.
- o Accidents evaluated qualitatively or semi-quantitatively.
- o Potential design, procedure, equipment vulnerabilities identified.
- o Assumptions made on system functions and operator actions needed for safety are explicitly identify.
- o Derivation of estimate for system failure & operator error.
- o Uncertainties discussed and accounted for.
- o Highest risk scenarios discussed along with potential for controls on operations to reduce risk.
- o For low risk scenarios cost effective or simple fixes to reduce risk that were identified in PHA discussed.
- o Review controls needed related to vulnerabilities and assumptions.

  - identify existing OSR's/controls needed
  - identify restrictions on operations
  - create new OSR's
  - delete OSR's no longer needed

o Does the logic flow from hazard identification to hazard controls.

- Radiological
- Toxicological
- Criticality
- Radiological Control
- Training
- Surveillances
- Maintenance
- Conduct of Operations
- Configuration Management
- Quality Assurance
- D&D

8.0 GENERIC REVIEW AND APPROVAL PROCESS

8.1 SCOPE

This chapter provides the guidance necessary for review and approval of nuclear safety documentation for Hanford nuclear facilities. Safety Documentation includes, but is not limited to, Safety Analysis Reports (SAR), Safety Analyses, Basis for Interim Operation (BIO), Technical Safety Requirements (TSR), Operational Safety Requirements (OSR), and any other documents meeting the intent of DOE 5480.23 or 5480.22.

8.2 APPLICABILITY

The provisions of this procedure are applicable to the Richland Operations Office (RL) personnel responsible for direction, reviewing, and approving safety documents. This procedure is not applicable to contractors.

8.3 EXISTING POLICY

8.3.1 Existing Requirements

a. DOE Order 5480.22, *Technical Safety Requirements*, U.S. Department of Energy, Washington, D.C. (2/25/92)

b. DOE Order 5480.23, *Nuclear Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C., (4/10/92)

c. DOE Order 5480.21, *Unreviewed Safety Questions*, U.S. Department of Energy, Washington, D.C., (12/24/91)

8.3.2 Existing Guidance

a. DOE-EM-STD-5502-94, *DOE Limited Standard - Hazard Baseline Documentation*

b. DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23, Nuclear Safety Analysis Reports*

c. DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*

d. DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*

8.3.3 General Requirements

a. The Approval Authority for Safety Documentation is defined in the RL Authorities and Responsibilities Manual.

b. The Approval Authority is the only individual with the authority to make decisions required by DOE Orders or chose options allowed by DOE Orders (e.g., merging of Preliminary SAR and Final SAR, SAR preparation and submittal for nonfacility nuclear operations). Further delegations must be formal and in accordance with all conditions and requirements accompanying DOE-Headquarters (HQ) delegation to RL.

c. The review and approval process presented in Figure 8.1 shall be used.

d. The Office of Environment, Safety and Health (ESH) has concurrence responsibility relative to DOE nuclear safety policy and evaluation processes for all Safety Documentation approval actions. Therefore, line organizations shall notify ESH of pending Safety Document reviews in a timely fashion.

e. Approval of a Safety Document or other decision addressed by this procedure is indicated by the Approval Authority's signature on a DOE letter to the appropriate recipient (i.e., contractor, Departmental Cognizant Secretarial Officer, Assistant Manager [AM], etc.). The letter shall include documentation recommending approval action from the applicable RL line management organization, including signatures of the following as a minimum:

- Cognizant AM
- Cognizant Division Director

ESH concurrence or non-concurrence with the Safety Document or other safety analysis related decision shall be documented by a memorandum from the Director, ESH, to the Approval Authority (forwarded to the cognizant AM for inclusion in the approval package). The memorandum will describe reviews/assessments performed, and will present conclusions or recommendations. This memorandum must be included in the approval transmittal.

The approval package is shown pictorially in Figure 8.2.

8.4 EXPECTATIONS

Nuclear Safety Documentation is typically prepared by the Contractor, or subcontractor performing work for the contractor responsible for operating a nuclear facility or conducting a nonfacility nuclear activity. Following contractor review and approval (Tier 1 review), the Safety Documentation is transmitted to RL for DOE review and approval (Tier 2 and optional Tier 3 review). The review and approval process is presented in Figure 8.1.

Graded Approach - In applying the graded approach (refer to Chapter 16, Graded Approach) to reviews of safety documentation, expectations for content and level of detail should be based on the hazards posed by the nuclear facility. In developing the scope of RL review for a given safety document the technical and regulatory complexity of the safety documentation should also be considered. Proposed changes to safety documents that are straight forward and not technically complex should require limited RL review to determine acceptability of the change. The review and approval process should be graded accordingly such that a defensible basis for approval is developed while minimizing expenditure of resources.

Reviews - Tier 2 and Tier 3 reviews should each consist of two phases:

- A review of the documentation resulting in specific findings requiring resolution by the contractor; and,

- A confirmatory review of the revised Safety Documentation to assure that the review findings are adequately addressed.

The Tier 2 review and resultant recommendations will be documented in a Safety Evaluation Report (SER) (see Section 11.6.3).

Review Guidance - Review guides to be used in the review of Safety Documentation must be based on DOE or other higher tier requirements (Code of Federal Regulations, etc.). Application of the graded approach, based on the hazards posed by the facility or non-facility operation, will define the level of detail expected in a Safety Document. A DOE 5480.23 compliant SAR is expected to address each topic listed in the Order, if only to state that the topic is not applicable to the subject of the SAR. Note that in these cases, adequate justification must be given in the Safety Document to allow the reviewer to reach the same conclusion as the author, and to subsequently allow documentation in the SER. DOE-STD-3009-94 provides guidance for topics and content to be included in a SAR and TSR.

BIOs - BIOs (and ISBs[6])(refer to Chapter 7) are Safety Documents generated by Hanford contractors as part of the contractors' implementation plan for coming into compliance with DOE 5480.22 and 5480.23. Guidance for content of these Safety Documents is provided in DOE-STD-3011-94. It should be noted that many Hanford facilities initiated development of BIOs prior to DOE issuance of DOE-STD-3011-94. This should be considered in development of RL review plans for these documents.

[6]ISB documents are generated by WHC to meet DOE 5480.23 requirements for a BIO.

Elimination of OSR controls - Given that the majority of Hanford nuclear facilities are no longer in an operational/processing mode, OSR controls and other commitments recognized as part of the current Authorization Basis may no longer be necessary. DOE approval is required to modify or eliminate OSR controls and commitments. Therefore, Safety Documents may be submitted to RL for approval of modification or elimination of controls and/or commitments. Attachment 1 provides guidance for the justification that supports elimination of existing commitments or OSR-level controls.

Unreviewed Safety Questions (USQ) and Proposed Changes (refer to Chapter 11) - Only portions of existing documentation may require modification as a result of a USQ or a proposed change. In these situations the same approach should be applied as described above - i.e., use DOE requirements as a review guide and systematically determine applicability of each requirement/topic for the review process based on the subject and scope of the changes.

Use of references - Safety Documentation must clearly report limitations and major assumptions associated with references so reviewers are not mislead concerning the limitations of scope, coverage, or assumptions of material in the safety analysis proper or in supporting material. The following guidelines should be used in the review of Safety Documentation:

- Compliance documents (laws, regulations, orders, industry-accepted standards): These documents are readily available and may be referenced without any summary or abstract.

- Supporting documents (studies, analysis, calculations): These documents may be referenced provided each is summarized in sufficient detail to allow a reviewer to make an independent evaluation of the technical conclusion which the reference is intended to support. Supporting documents in draft form shall not be referenced.

- Implementing documents (programs, procedures, instructions): Broad references to these documents are not expected in Safety Documentation. The Safety Documentation must contain commitments for developing and maintaining programs that implement the specifications and criteria of upper tier requirements documents (Rules, Codes, Orders, Standards, etc.). Sufficient description of the program should be provided to indicate the requirements of these upper tier documents will be satisfied by the program.

8.5 PROCESS

The general process for review and approval of nuclear Safety Documents is presented graphically in Figure 8.1.

Tier 2 Review

a. **Acceptance Review** - The acceptance review hinges primarily on whether or not all pertinent matters have been addressed (i.e., applicable rules, orders, and standards) and not necessarily on whether the approach to resolving matters is acceptable. In general, the acceptance review is intended to verify that all the "pieces" are in the document and that the document is adequate to justify expenditure of resources on a technical review. Significant operational and/or technical issues identified during the acceptance review that would impair the conduct of a technical review should also be identified and result in not accepting the document. If the acceptance review results in rejection of a Safety Document, the rejection should be formally transmitted to the originating contractor along with identification of specific deficiencies and recommendations for revising and resubmitting the document.

b. **Technical Review** - The technical review of a Safety Document is intended to be a managed, disciplined, technically based review conducted by a review team. The review team should be composed of individuals with a broad technical base in order to judge the adequacy of the document.

c. **Review Plans** - A review plan is expected to be developed for each Tier 2 review and is expected to define the scope and bounds of the review, designate members of the review team, and establish basic rules for the conduct of the review. The review plan is expected to be as brief as possible while achieving its purpose. Attachment 2 presents guidance for content of a review plan. The review plan should be prepared by a designated Review Team Leader, and approved by line management.

d. **Review Team** - Individuals with the following expertise should comprise the review team:

- Nuclear safety analysis, policy, regulations, standards, techniques;
- Knowledge of the facility or non-facility operations;
- Subject matter experts as appropriate (e.g., fire analysis, industrial hygienist, structural, etc.).

e. **Managed Review** - As a managed review, all proposed comments should be collectively reviewed by the review team and agreement reached on the validity of each comment before they are transmitted to the Contractor. Comments resulting from the Tier 2 review shall be documented and transmitted to the originating contractor for resolution. Noncompliance with order requirements must be processed as an exemption request.

f. **Tier 2 Review Procedure** - Attachment 3 presents an acceptable approach for performing a Tier 2 review. RL line management may utilize the procedure in Attachment 3 or perform the Tier 2 review in accordance with internal procedures. Line management internal procedures must meet the requirements and expectations of this manual.

g. **SER** - The SER is written by line management based on the Tier 2 technical review. Upon approval of subject Safety Documentation, line management will retain ownership of the SER.

h. **Recommendation for Approval** - RL line management must make their determination of whether or not to recommend the document for approval based on the Tier 2 review, as documented in a SER.

i. **Tier 2 and Tier 3 Review Integration** - Findings of a Tier 3 review may result in modifications to the Safety Documentation and require changes to the SER and line management recommendations. Ultimately, line management must assume ownership of the Safety Documentation and related SER as part of the facility Authorization Basis. Therefore, line management must ensure that this integration occurs.

Tier 3 Review

a. **General** - Tier 3 reviews are managed, independent evaluations of Safety Documentation to determine if the analysis and controls proposed for a facility or non-facility operation or activity are adequate to identify management, design, construction, operation, and engineering characteristics necessary to protect the public, workers, and the environment from related hazards.

b. **Decision to Perform Tier 3 Review** - Tier 3 reviews are performed at the request of the Approval Authority. Considerations affecting this decision may include:

- The facility is a higher hazard facility or presents unique hazards compared with other Hanford nuclear facilities;
- The facility is a new facility, warranting the added rigor of a Tier 3 review; or
- Any special circumstance recognized by the Approval Authority.

c. **Scope of Tier 3 Review** - The scope of a Tier 3 review may range from a limited overview by qualified individuals, to a rigorous technical review performed by industry experts in various technical disciplines. The Approval Authority is responsible for determining the general scope of the Tier 3 review and for appointing an individual to initiate, arrange, and coordinate the Tier 3 review. The individual appointed to administer the Tier 3 review need not be independent from line management.

d. **Review Team Leader** - The appointed Tier 3 review team leader must be independent from line management. The review team leader develops the detailed review plan based on the general scope defined by the Approval Authority, determines the needed disciplines and qualifications to perform the review, and identifies team members accordingly.

e. **Product of the Tier 3 Review** - The product of a Tier 3 review is a recommendation made to the Approval Authority independent of the recommendations of line management. These recommendations will be transmitted in the form of a memorandum or letter. See Section 8.5.i for Tier 2 and 3 review integration and SER development.

f. **Independence** - In order to maintain the independent posture of the Tier 3 review, members should be selected based on independence from:

- Project activities sponsoring the document;
- Program activities that result in direct involvement with document development; and
- Other reviews of the document.

g. **Protocol** - Recommendations of the Tier 3 review are made to the Approval Authority. Interface with the contractor (communication, tours, transmittal of findings, etc.) must be through RL line management. The SER must identify those documents that comprise the nuclear safety authorization basis for the nuclear facility, or specific activity within a nuclear facility, for which the contractors nuclear safety document was developed.

SER - The SER is a report which documents and validates the Safety Basis and any other relevant factor upon which DOE authorizes a facility to be constructed and perform pre-operational testing, to be operated, or to be shut down and decommissioned. A SER may define conditions and/or restrictions imposed by DOE other than those proposed by the contractor in the SAR and related TSR/OSR. Therefore, the SER and related safety documentation becomes part of the Authorization Basis for facility operation. The SER must be transmitted to the contractor along with the SAR, and recognized by the contractor as part of the Authorization Basis.

An SER is expected to be generated to document the basis and conditions for DOE approval of:

- Safety Documentation supporting construction and/or pre-operational testing; or
- Safety Documentation supporting operation, shut down or decommissioning; or
- Revisions made to the Authorization Basis in accordance with DOE 5480.21; or

- Each phase or stage of SAR development when a SAR is developed in accordance with DOE 5480.23 paragraph 9a(3); or

- A justification for continued operation resulting from a USQ or other operational need.

If approval authority for a given facility has not been delegated to RL, RL generation of a SER is required only on the direction of HQ.

Chapter 10 presents guidance for SER preparation.

Records - The quality records generated in response to the requirements of this procedure shall be processed in accordance with applicable RL directives and procedures. The records that may be generated as a result of this procedure include:

- Tier 2 review records (record of review comments), review plan, reviewer qualifications, transmittals);

- Tier 3 review records (record of review comments, review plan, pertinent meeting minutes, correspondence);

- SER;

- Formal recommendations.

FIGURE 8.1

- Generic Nuclear Safety Document Review and Approval Process -

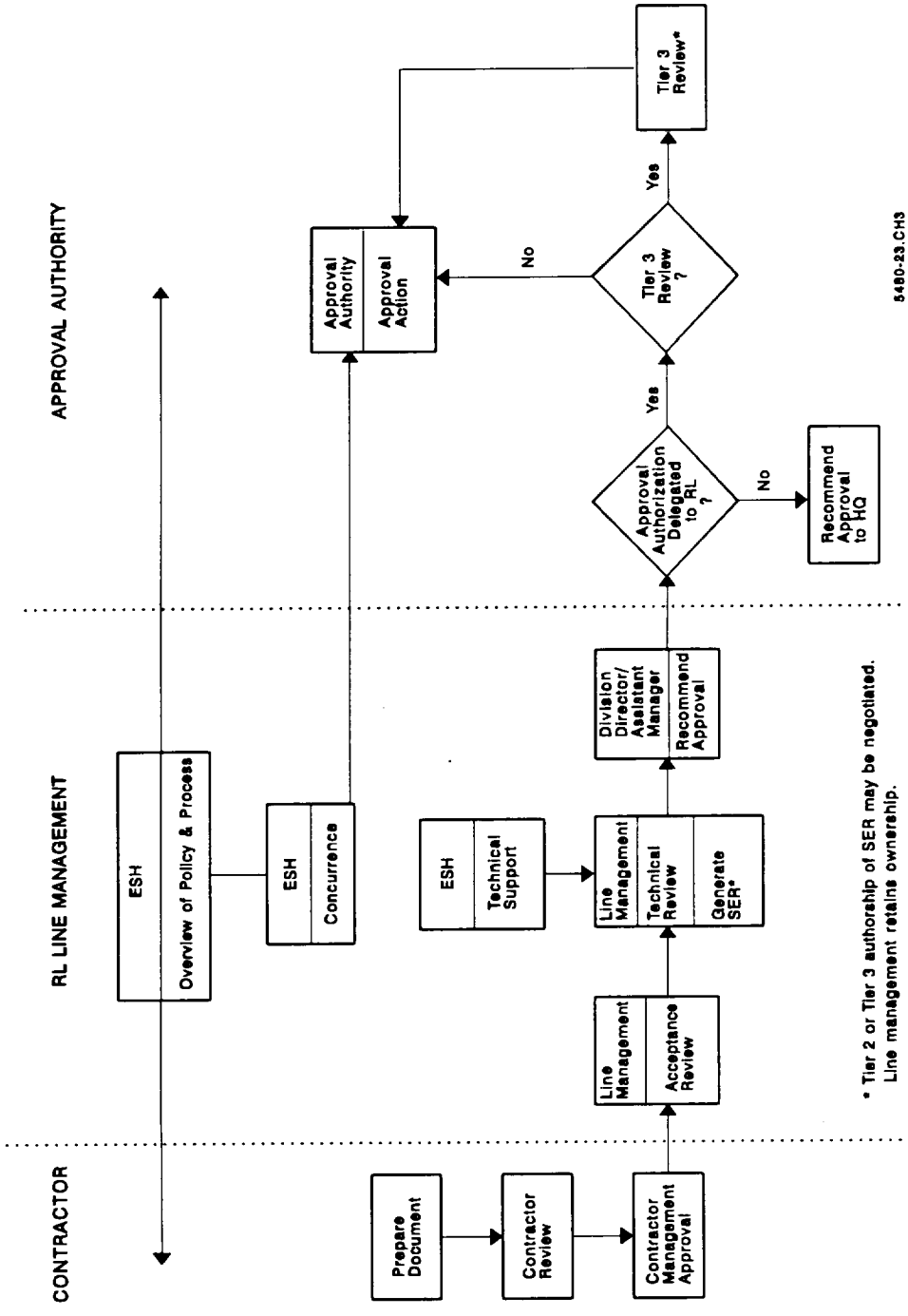
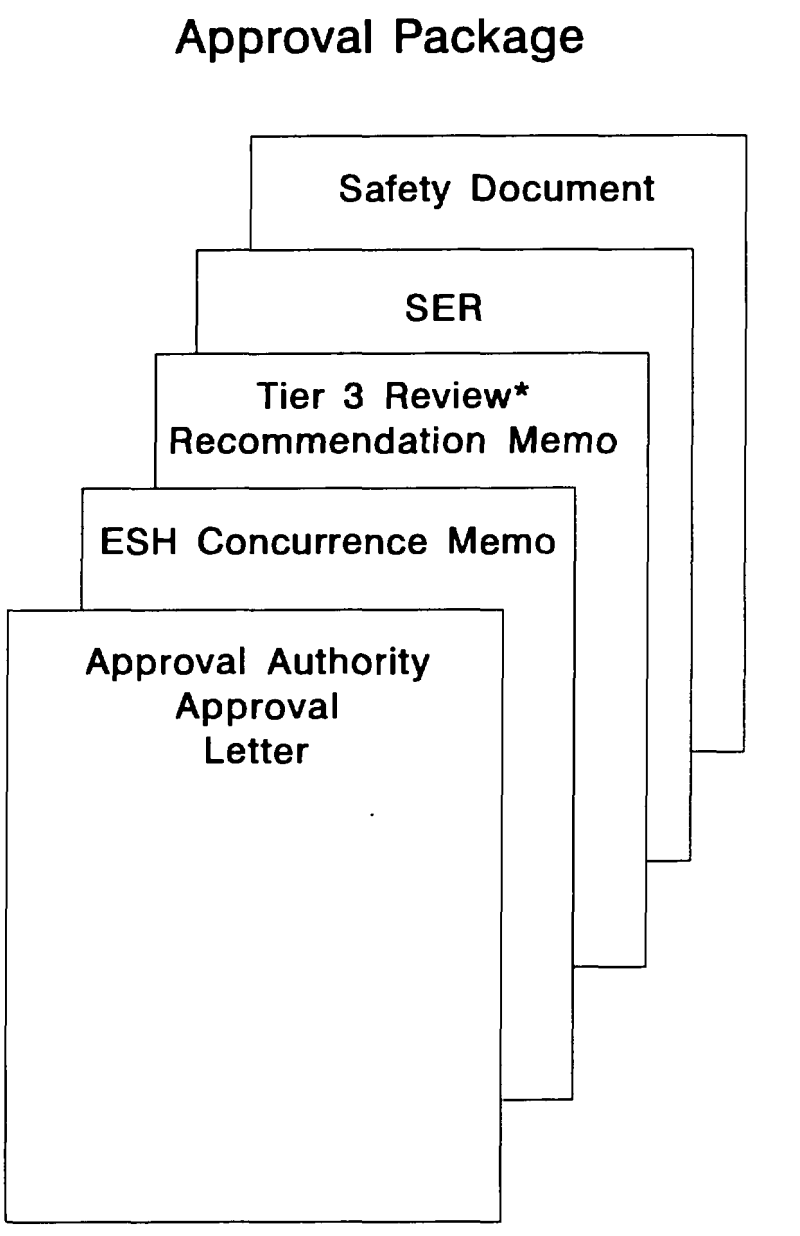


FIGURE 8.2

- Approval Package -



ATTACHMENT 1

- Guidance for Review of Justifications for Deletion of OSR-Level Controls -

BIOs, as well as changes to Safety Documents, can be used to delete existing controls (i.e., OSRs) if the controls are no longer applicable to a facility's mission or mode (e.g., extended surveillance and maintenance). It is expected that proposed deletion of controls will be technically justified and documented in the Safety Document. Documentation is expected to address:

a. Description of the control being deleted;

b. Why the control existed (basis, applicability);

c. What has changed such that the control is no longer applicable;

d. Proposed alternative controls, if applicable. This could be the case if hazards still exist and need to be controlled, but the current status of the facility results in reduced risk than previously estimated; or, current DOE guidance indicates that different types of controls are adequate (e.g., criticality controls may be addressed through an OSR administrative control instead of limiting conditions for operations).

ATTACHMENT 2

Review Plans

The following information should be provided in the plan as applicable:

- Purpose - purpose of the subject review plan.
- Background - basis for contractor submittal of the subject document.
- Scope - Identify major activities that will be authorized upon approval of the document. Also establish compliance with the criteria and guidelines of applicable rules, orders, etc.
- Limitations - Define boundaries of the review (e.g., partial reviews), if any.
- Review Team Members - Names of individuals recommended to review the document. Include qualifications as an attachment to the plan.
- RL and Contractor Contacts - list of individuals available to assist in the review. Forms lines of communication.
- Review Assignments - specific sections may be assigned to specific reviewers according to expertise; and/or, each reviewer may be instructed to review the document in its entirety.
- Schedule - milestones for significant phases of the review should be defined.
- General Requirements - instruction on documentation of comments, etc.
- Review and Acceptance Criteria - Applicable rules, orders, and guidance.
- References - references applicable to the review.

ATTACHMENT 3

- Procedure for Tier 2 Reviews -

Performer	Action
Division Director (DD), Cognizant Director (CD)	• Upon notification by the Contractor of pending transmittal of the Safety Document, designate a review team leader.
	• Notify ESH.
Review Team Leader	• On receipt of the document, initiate an acceptance review. If found unacceptable, formally return to contractor with documented deficiencies and directions for revising and resubmitting the Safety Document.
	• Determine the scope of the technical review by identifying the level of detail contained in, and the technical areas/disciplines encompassed by, the subject Safety Document, and the hazard category of the facility. Request technical support from ESH as needed.
	• Develop a review plan for the document.
	• Determine the number of team members and technical disciplines required to ensure an adequate technical review. Obtain support for the review team by identifying resources from QSH, other RL divisions, and support contractors as dictated by the technical expertise required for the review.
DD, CD	• Approve the review plan and selection of review team members.
Tier 2 Review Team	• Perform and document the Tier 2 technical review in accordance with the review plan.
Review Team Leader	• Coordinate discussion and resolution of comments between the Contractor and the review team.
	• Ensure that a SER is developed per Section 10.0.
	• Upon satisfactory disposition of review team comments, submit the document and SER, through the DD and AM, to the RL Manager, recommending approval and/or other action.

Director, ESH	• Originate concurrence/nonconcurrence memo to the Approval Authority, forwarded to the cognizant AM for inclusion in the approval package.
Cognizant AM	• Assemble Approval Package (Figure 8.2).
	• Submit the Approval Package to the Approval Authority.

9.0 RISK ACCEPTANCE GUIDELINES

9.1 SCOPE

The identification of the risks a facility poses to the public, onsite workers, facility workers and the environment is based on the radiological, chemical, and other hazards present in that facility. Risk acceptance is established by the Richland Operations Office (RL) line management responsible for the individual facility. This guide is intended to provide a consistent approach to the risk acceptance process and aid in both limiting the overall risk of the Hanford site and allowing specific acceptance of risks based on importance to the Hanford mission.

9.2 APPLICABILITY

Each facility represents a unique collection of hazards and thus risks that it poses to the public, site workers, and facility workers. The acceptance of that risk is the responsibility of RL line management for each individual facility, and as such applies to all Hanford facilities. Many facilities are limited to administrative activities and are primarily focused on industrial health and safety risk reduction measures. This guide is focused on facilities that contain radiological or chemical hazards that are either current or former process facilities, non-facility environmental restoration sites (e.g. cribs, trenches), existing process or storage facilities, or new process or storage facilities that are classified as nuclear facilities per DOE-STD-1027-92.

9.3 EXISTING POLICY

9.3.1 Existing Guidance

a. SEN-35-91, *Nuclear Safety Policy*

b. DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*

c. DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*

9.4 EXPECTATIONS

The facility safety documentation should clearly present risks associated with each hazard. It should also present the contractor's rationale justifying acceptability of that risk.

Overall facility risk should also be identified and justified using one of two approaches:

a. For Interim safety documents such as Basis for Interim Operations the justification should be based on inclusion of programmatic safety management, qualitative identification of vulnerabilities and operational restrictions, and identification of interim controls along with their bases.

b. For DOE 5480.23 SARs the justification should be based on the level of overall facility risk, importance of that facility to the Hanford mission, cost benefits of reducing risk further, and type of facility. There should also be a comparison to the nuclear safety goals found in SEN-35-91, and a conclusion made based on that comparison.

9.5 PROCESS

RL line management is responsible for accepting risks their facilities pose to the public, site workers, facility workers, and the environment. In addition RL and contractor management are responsible for continuously pursuing reasonable reductions in risk and not merely meeting a minimal set of acceptable requirements.

Because each facility presents a unique set of risks there is no single level of risk universally applicable. RL management must approve the risks presented by their facility on a case by case basis. To accomplish this requires continuous interaction during development of facility safety documents, which then establishes the facility safety basis. Discussions between RL and the contractor should occur as hazards and risks are identified, in order for RL to recognize both the risks they believe are sufficiently low as to warrant no further action and those risks that may need to be reduced. Therefore, except in extreme cases, there is no such thing as an obviously acceptable or unacceptable risk based solely on whether it falls above or below an arbitrary or imposed risk guideline.

A number of variables should be taken into account when deciding whether to accept identified risks or pursue measures to reduce those risks. Consideration should be given to the following variables, at a minimum.

- Cost benefit: A direct comparison of the how much reduction in risk is achieved vs the cost in dollars is pertinent. The reduction in risk should be commensurate with the cost involved.

- Mission importance: How vital is that facility's activities to the overall mission of Hanford, DOE, or stakeholders. Acceptance of higher risks may be necessary for facilities that are key to our success, relative to those that are not.

- Type of Facility: Some facilities present an inherently higher risk profile than others. The higher risk is commensurate with the type of facility. For instance, one would expect less risk from a fuel storage facility than from an active fuel processing plant or reactor.

- Magnitude of Hazards: Since we are dealing mainly with existing facilities we often are presented with varying levels of existing hazards. Some process facilities will contain greater quantities of hazardous material than others and so may present greater risks despite the fact that they are both the same type of facility.

In the end any decision made, whether above or below an established acceptance curve, must be defensible based on the above considerations and any other factors deemed important with respect to its overall effect on Project Hanford.

10.0 SAFETY EVALUATION REPORT (SER)

10.1 SCOPE

This chapter defines the Richland Operations Office (RL) policy and expectations for SER.

An SER is a report which documents and validates the Safety Basis and any other relevant factor upon which the U.S. Department of Energy (DOE) authorizes a Facility to be constructed and perform pre-operational testing, to be operated, or to be shut down and decommissioned; and documents the DOE review process utilized to reach its conclusions. An SER may define conditions and/or restrictions to be imposed by DOE, in addition to those defined by the Contractor in the Safety Analysis (SA) and related Technical Safety Requirements (TSRs)/Operational Safety Requirements. Therefore, the SER uniquely identifies and defines the Authorization Basis for RL approval of facility operations by referencing other documents or identifying specific elements that are to be considered part of the Authorization Basis. It must be transmitted to the Contractor along with the SA, and is itself identified as part of the Authorization Basis.

10.2 APPLICABILITY

The SER is applicable to nuclear facilities and non-facility nuclear operations as defined in DOE 5480.23 and Chapter 4, Hazard Categorization , unless an exemption is granted from the requirements of the Order

10.3 EXISTING POLICY

10.3.1 Existing Requirements

a. DOE 5480.23, *Nuclear Safety Analysis Reports*

10.3.2 Existing Guidance

a. DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Safety Analysis Reports.*

b. DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23, Nuclear Safety Analysis Reports.*

10.4 EXPECTATIONS

An SER is expected to be generated to document the basis and conditions for DOE approval of:

a. Safety documentation supporting construction and/or pre-operational testing; or

b. Safety documentation supporting operation, shut-down, or decommissioning; or

c. Revisions made to the Nuclear Safety Authorization Basis in accordance with DOE 5480.21; or

d. Each phase or stage of SAR development when a SAR is developed in accordance with DOE 5480.23 paragraph 9.a(3); or

e. A Justification for Continued Operation (JCO)/Justification for Interim Operation (JIO).

If approval authority for a given facility has not been delegated to RL, RL generation of an SER is required only on the direction of DOE-Headquarters.

Overall content of the SER shall be based on a graded approach as described in DOE 5480.23. An SER being written in response to an individual phase or stage of SAR development, USQ, or JCO/JIO shall be commensurate with the scope of the related safety documentation. An SER may be in the form of a formal report, an attachment to a formal DOE transmittal, or may be part of the text of a formal DOE transmittal.

Upon DOE approval of safety documentation, the basis of which is documented by an SER, the approved safety document and SER shall be transmitted to the contractor by the Approval Authority, as part of the nuclear safety authorization basis for the applicable facility.

Attachment 10-1 presents guidance for a full scope SER based on DOE 5480.23. For a given review of a safety document, the applicable portions of Attachment 10-1 should be used. Few Hanford facilities are expected to require a full scope SER.

ATTACHMENT 10-1
SER CONTENT AND FORMAT GUIDANCE

EXECUTIVE SUMMARY

State the purpose of the SER, i.e., to identify the environmental, safety, and health bases upon which authorization decisions are to be made, and to identify the nuclear safety authorization basis for the applicable facility.

Summarize the facility description, the action(s) to be authorized, the review of the SAR, environmental requirements, TSRs, official readiness review/operational readiness evaluation efforts, any exemptions or deviations from safety requirements, special validation studies and other safety considerations, programmatic considerations, and list the conditions and recommendations. Identify those documents that comprise the nuclear safety authorization basis for the nuclear facility or specific activity within a nuclear facility for which the contractors nuclear safety document was developed. Identify unique features that affect facility operation.

Indicate the contents of appendices.

Do **not** paraphrase conclusions; simply repeat conclusions and or summary statements.

Reference chapters of the SER and appendices that the summary material is taken from.

The executive summary should be no more than two single spaced pages.

1.0 INTRODUCTION

1.1 PURPOSE

This section identifies the proposed process operations(s) and facility for which approval is sought. This should reflect the total purpose of the SER.

It should also identify the DOE Field or Area Office, and the Environmental Management (EM) organizational elements that are responsible for the activity.

1.2 BACKGROUND/HISTORY OF THE FACILITY

The information to be included in this section should be abstracted from the facility SARs (current and former).

Provide the following information about the facility/site:

- A brief site description (including the site location, site features and highlights that have significant effects in the facility, and collated facilities);

- The Maintenance & Operating (M&O) or maintenance and integrating contractor (M&O or Management and Integration [M&I]);

Provide the following information about the facility/process:

- The origin and background of the facility (i.e., the facility mission as originally designed, subsequent changes over time, and as it currently is proposed to be operated). This information is particularly important for existing facilities with changing missions, or where near-term decontamination and decommissioning are involved.

- The basis process material flow and balance for the product, waste, and effluent streams; and

- A flow diagram and explanation to permit an overall understanding of all processes and their interdependencies as they relate to the safety basis.

2.0 SAR REVIEW AND APPROVAL

Approval of the SAR is based primarily upon the technical review performed by the RL line organization. The review findings are detailed in an Appendix. Information for inclusion in sections 2.1, 2.2, 2.3, and 2.4 is available in either this Appendix or the SAR itself.

When issued, DOE Order 5480.23, *Nuclear Safety Analysis Reports*, required operating contractors to submit for DOE approval the safety bases for interim operations or restrictions on interim operations, and administrative controls to be effected until such time as a SAR is completed and approved. For such cases, provide the information requested in following sections to the extent it is contained in the interim basis provided by the M&O and M&I. Summarize other information included in the interim basis judged pertinent to the approval authorization.

2.1 ADEQUATE CONTROL OF HAZARDS

2.1.1 Identification of Hazards

Present the types and relative magnitude of hazards based upon a defined limiting inventory of radioactive material and hazardous chemicals.

2.1.2 Design Features

2.1.2.1 Safety Class and Technical Safety Requirement-Related Structures, Systems, and Components. Identify structures, systems, and components classified as Safety Class and/or for which a TSR has been established and state their safety function. This section is intended to include only those structures, systems, and components that are part of the primary success path of a safety sequence analysis, and those support and actuation systems necessary for them to function successfully. State the applicable codes, standards, and guides for the design of these items, and the associated Quality Assurance Program that monitors their design, procurement and fabrication. Identify any noncompliance to the applicable codes, standards, and guides, and refer the reader to Chapter 6 for a discussion of exemptions.

2.1.2.2 Other Structures, Systems, and Components. Other design features (i.e., structures, systems, and components not classified as Safety Class and/or not specified in TSRs) may play an important role in the control of hazards, particularly as related to worker safety. Identify any such items and state the applicable codes,standards, and guides for their design. Identify any noncompliance to the applicable codes, standards, and guides, and refer the reader to Chapter 6 for a discussion of exemptions.

2.1.3 Administrative Features

Summarize the principal controlling administrative features (e.g., radiation and hazardous material programs including as low as reasonably achievable, procedures, training, configuration control, equipment qualification, etc.) which ensure safe operation. As was the case with design features, it is intended that a graded approach be applied that emphasizes programs specified as administrative control TSRs. State whether the programs, as defined in the SAR, meet applicable program requirements established by DOE. Importantly, the mechanism(s) by which the contractor will measure program effectiveness should be identified. Cross reference the chapters of the SER which describe administrative memorandum of understanding, commitments and requirements.

2.2 WASTE MANAGEMENT

2.2.1 Gaseous

Quantify the concentrations of radioactive and nonradioactive hazardous materials in gaseous effluent streams. Briefly describe the derivation of values (e.g., calculated from the process flowsheet, based on historical measurements, etc.). Compare the concentration to applicable standards.

2.2.2 Liquid

Quantify the concentrations of radioactive and nonradioactive hazardous materials liquid effluent streams. Briefly describe the derivation of the values (e.g., calculated from the process flowsheet, based on historical measurements, etc.). Compare the concentrations to applicable standards.

2.2.3 Solid

Identify the types of solid wastes generated (e.g., low level, transuranic, hazardous, mixed) and tabulated annual generation rates.

2.3 OPERATIONAL EXPOSURES

2.3.1 Radiological

Present the estimated annual occupation exposures of operational personnel (including maintenance). Compare to applicable standards.

2.3.2 Nonradiological Hazardous Materials

Present the estimated concentrations of hazardous materials to which operators are to be exposed during the conduct of routine operations and the estimated annual exposures. Compare these concentrations to applicable standards.

2.4 ACCIDENT ANALYSIS

2.4.1 Internally Initiated Accidents

Present the results of the analysis of operational accidents initiated internal to the facility. Include the estimated radiological and non radiological accident effects to facility workers, onsite personnel, and the public. Also include the estimated/calculated annual probability of occurrence for each accident, and discuss the uncertainties in the estimates. Compare to applicable criteria (e.g., Draft Guidelines for Assessment of Consequences from Potential Accidents at DOE Nuclear Facilities and Activities, or the DOE Nuclear Safety Goals).

2.4.2 Externally Initiated Accidents

2.4.2.1 Severe Natural Phenomenon Hazards. Present the information requested in section 2.4.1 above for analysis of severe natural phenomenon potentially impacting the facility.

2.4.2.2 Man-Caused Events. Present the information requested in section 2.4.1 for accidents (if any) initiated by man-caused events external to the subject facility (e.g., explosions or fires at nearby facilities, airplane crashes, transportation accidents, etc.).

2.5 TSR DERIVATION

State that the TSRs, as discussed in Chapter 4, will aid in the control of hazardous.

2.6 CONCLUSIONS

This section should conclude that the SAR adequately documents the safety analysis and that the result of the analysis are acceptable.

3.0 ENVIRONMENTAL DOCUMENTATION REQUIREMENTS

The purpose of this chapter is to identify those environmental permits or agreements requiring approval by other federal, state or local agencies prior to the commencement of construction or operation.

3.1 LISTING OF REQUIREMENTS

Summarize all requirements resulting from environmental impacts due to the operation of the facility under review. Specifically identify those key activities regulated by DOE and those under the jurisdiction of other federal, state or local agencies which must be permitted and/or verified prior to implementing the authorization for construction or operation.

3.2 VERIFICATION

The base document identifying the regulatory requirements is DOE Order 5400.1 entitled *General Environmental Protection Program.* The basic regulatory compliance document is the facility Environmental Impact Statement (EIS) mandated by the National Environmental Policy Act, as described in DOE Order 5440.1C.

Key elements in this verification include the determination that the appropriate regulations have been applied to the facility, and that any exemptions from the regulations have been clearly stated and explicitly accepted by the appropriate regulatory agencies. Federal, state and local agency requirements should, as a minimum, be identified by review of regulatory activities for similar facilities within these jurisdictions. A listing of all applicable regulations should be prepared. For each requirement, the document prepared to show compliance with the requirement, and the related approval document (e.g., permit), should be listed.

3.3 CONCLUSIONS

This section should identify all the key requirements/permits/conditions which must be met prior to implementing the authorized construction or operation. Approved exemptions, deviations, etc., as well as committed future actions required to accomplish full compliance should be noted. The findings should also include any limitations imposed on facility operations, any others imposed as conditions of agency approvals, permits, or other authorizations. Finally, any requirements, permits or conditions which have not yet been met, but which must be in place to implement the authorization should be identified.

4.0 TSR REVIEW AND APPROVAL

Approval of the TSR is based primarily upon the detailed technical review of the TSR. The detailed findings of this review are to be provided in Appendix and summarized here. If such a review has not been accomplished, or is not complete when this SER is prepared, the review should be subsequently appended to ensure that a complete record of authorization exists.

4.1 TECHNICAL REQUIREMENTS

Confirm that the TSR establishes adequate technical requirements for:

- Safety Limits;
- Operating Limits;
- Limiting Control Settings;
- Limiting Conditions for Operation; and
- Surveillance Requirements;

to ensure maintenance of the safety basis identified in the SAR. Briefly summarize the TSRs and identify the purpose. This summary may be presented in tabular form, if appropriate.

4.2 ADMINISTRATIVE CONTROLS (AC)

Confirm that adequate commitments have been made to establish minimum requirements relating to organization and management, procedures, recordkeeping, reviews and audits necessary to ensure safe operation of the facility.

Also, confirm that the TSR has identified staff positions important to safety and has specified minimum qualifications (education, training and experience) for these positions. Commitments to training and retraining requirements should be included.

Finally, confirm that the TSR adequately addresses what action(s) shall be taken if a TSR is violated.

Where appropriate, organization charts and/or tables may be added to provide supporting evidence.

4.3 CONCLUSIONS

State that:

- The TSR meets the requirements of DOE 5480.22. If not, identify deviations and any additional requirements needed to ensure safe operation.
- Contractor surveillance requirements will be conducted to ensure continued compliance.
- The TSRs are consistent with the derivation bases provided in the SAR.

5.0 EXEMPTIONS AND DEVIATIONS FROM SAFETY REQUIREMENTS

This Chapter identifies all safety requirements that will not be met that require DOE approval. These fall into two categories, exemptions and deviations. An exemption is when a requirement will not be met and no alternate action is to be taken. A deviation is when a requirement will not be met, but an equivalent alternative is provided that meets the intent of that requirement.

5.1 EXEMPTIONS

Identify requirements for which exemptions have been granted. For each, identify the document that promulgates the requirement, identify (e.g., memo number) the DOE document that provides approval, and summarize the basis for the exemption.

5.2 DEVIATIONS

Identify requirements for which a deviation has been or will be granted. For each, reference the document establishing the requirement, identify the M&O or M&I document that justifies the alternate provided is equivalent for the proposed function, and list the DOE document that provides approval. Verify that adequate basis for each deviation is provided.

5.3 CONCLUSIONS

Provide a statement of the acceptability of exemptions and deviations that apply to the facility. Identify the role of the Area or Field Office, and EM, in overseeing continued oversight of safety requirements. If warranted, include a statement that they are adequately staffed to fulfill their responsibilities. If staffing is not adequate, indicate the plans to improve performance.

6.0 OTHER SAFETY CONSIDERATIONS

This chapter identifies and describes information related to safety and environmental protection that is judged pertinent to the authorization decision-making process, but is not addressed in the SAR, EIS, any interim safety basis, or other safety or environmental documentation reference in other Chapters of the SER. Note that the material for this chapter is to be prepared on as-needed basis. It is anticipated that in the vast majority of cases existing safety and environmental documentation will provide a sufficient basis for authorization. The following sections represent examples of topics that conceivably could be included.

6.1 SPECIAL STUDIES

- Discuss any special considerations resulting from the use of special analytical tools, e.g., Probabilistic Risk Analysis, Failure Modes and Effects Analysis, Event Trees, Fault Trees, etc.. For example, present the results of any studies of accidents which shed light on more likely or average accident probabilities, consequences, or both.

- Discuss any validation studies that may be used to explain the conservatism existing in the accident analyses presented in the subject facility SAR.

6.2 COMPLIANCE SCHEDULE AGREEMENTS AND REQUIREMENTS IDENTIFICATION DOCUMENTS (RIDs)

- RIDs are documents that identify all requirements at a DOE facility, including those that were not implemented when the facility was authorized or subsequently updated that are important to the safe operation of the facility. Such documents generally are prepared for older facilities. For new facilities, the SAR constitutes the RIDs.

- For requirements that are not currently implemented, but are scheduled to be implemented in the future, reference the documents that request and approve or acknowledge the actions to be taken, and identify the schedule for implementation.

6.3 JCO OR JIO

- Assessments of safety at older facilities often require the successful assessment of existing safety bases to justify continued or interim operation. To the extent that such assessments are important to the authorization being considered, such should be summarized in this section.

7.0 PROGRAMMATIC CONSIDERATIONS

Discuss any programmatic considerations that should be addressed in authorizing the action to be taken that potentially warrants deviations or exemptions from safety and health requirements. Included are schedular, financial, cost/benefit, operational necessity, national security, congressional and/or executive directives, short-term limited use of a facility, and the availability and capability to adequately oversee contractor operations by DOE. For example not providing confinement and filtration for accidents involving releases of plutonium and other radioactive and hazardous materials from a waste storage facility for a few months while shipping arrangements are made may be warranted if no other practicable alternative exists. Another example is the continued assumption of hazards of waste tank storage until treatment such as vitrification/evaporation can be accomplished. That is, the hazards associated with moving, storing and treating waste by other means can be

substantially greater than continued storage, and/or the costs of such alternatives could be prohibitive or without satisfactory cost/benefit.

8.0 CONDITIONS/RECOMMENDATIONS

Summarize all conditions, recommendations, and associated bases relevant to the authorization from all other Chapters of the SER. Cross reference TSR and environmental requirements.

Identify explicitly whether the M&O/M&I or DOE is responsible for implementing or verifying a condition or recommendation. For those activities that are the responsibility of DOE, the specific organizational element in the Field Office and/or EM should be identified. For all conditions and recommendations, implementation dates should be supplied.

Cross reference the SER Chapter in which each condition or recommendation is discussed.

9.0 AUTHORIZATION BASIS

Identify those documents that comprise the nuclear safety authorization basis for the nuclear facility, or specific activity within a nuclear facility, for which the contractors nuclear safety document was developed. For each identify the document by name, date issued, and revision number. Also, if applicable, identify any portions of those documents which are specifically not approved.

10.0 REFERENCES

This chapter is to include references used in the body of the SER. The following format is suggested.

- For documents with a specified author(s) -

  Author, Date, Title (italicized or bold), Document Number, Revision (if applicable), Affiliation, Address.

  Example:

  Napier, B.A., 1988, *GENII - The Hanford Environmental Radiation Dosimetry Software System*, PNL-6584, Rev. 3, Pacific Northwest Laboratory, Richland, Wa.

- For documents without a specified author -

  Acronym of Issuing Organization, Date, Title, Document Number, Revision, Issuing Organization, Address

  Example:

  NRC, 1979, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*, Regulatory Guide 1.145, U.S. Nuclear Regulatory Commission, Washington, D.C.

  When an author or organization issues two or more documents in the same calendar year that are referenced, the first should be designated a, the second b, etc.

  Example:

  DOE, 1992a, *Nuclear Facility Safety Analysis Reports*, DOE Order 5480.23, U.S. Department of Energy, Washington D.C.

  DOE 1992b, *Unreviewed Safety Questions*, DOE Order 5480.21, U.S. Department of Energy, Washington D.C.

11.0 UNREVIEWED SAFETY QUESTION (USQ) PROCESS

11.1 SCOPE

This chapter identifies existing DOE policy and expectations for USQs and Justification for Interim Operations (JIO).

11.2 APPLICABILITY

The USQ process is applicable to nuclear facilities and non-facility nuclear operations and activities (including those facilities in transition, extended surveillance and maintenance, and decontamination and decommissioning) as defined in Chapter 4, Hazard Categorization Process, unless an exemption is granted from the requirements of DOE 5480.21. The USQ process applies to all aspects of a nuclear facility nuclear safety authorization basis, including the Safety Analysis Report (SAR), safety evaluation report, implementation plan, basis for interim operation, interim safety basis, technical safety requirements, operational safety requirements, and supporting documentation.

11.3 EXISTING POLICY

11.3.1 Existing Requirements

a. DOE Order 5480.21, *Unreviewed Safety Question*, U.S. Department of Energy, Washington, D.C., 12/24/91

b. 10 CFR 830, *Nuclear Safety Management* (All Parts), U.S. Department of Energy, Washington, D.C. (10 CFR 830.112 Final Rule, when issued)

11.3.2 Existing Guidance

a. DOE, 1994 Memorandum, *Delegation of Review and Approval Authority for Safety Documentation and for Startup/Restart for Environmental Management Field Activities*, Thomas P. Grumbly, EM-1, *etal.*, August 8, 1994.

11.4 EXPECTATIONS

Operations outside the existing authorization basis, such as during the discovery of a potentially inadequate safety analysis, WILL HAVE a JIO prepared.

a. Approval authority for a JIO is the recognized (formally delegated) approval authority for the facility SAR.

b. JIO format is not explicitly defined - however, format should roughly reflect applicable sections of a SAR as much as possible.

c. Expectations for JIO content include:

   1) The interim controls and/or restrictions shall be based on the best available information, analysis, and engineering judgement;

   2) A JIO is expected to estimate the risk associated with the interim operation;

   3) Describes what margins of safety are maintained;

   4) Describes how existing controls/restrictions maintain safe conditions;

   5) Describes the additional controls needed and how they ensure safe conditions.

d. A JIO remains in effect until the nuclear safety authorization basis has been updated and approved by DOE, or the discovered condition that initiated the USQ/JIO has been eliminated.

The USQ process in and of itself is not a change control process. The USQ process is a method to determine the approval authority required for changes to a facility and its authorization basis.

For any changes made to a facility and/or its operations/activities, the cognizant contractor must determine if the changes are safe prior to making the USQ determination. The USQ process is not in and of itself an assessment of safety.

Resolution of a USQ through review and approval of revised documents comprising the authorization basis shall be in accordance with Chapter 8, Generic Review and Approval Processes.

In accordance with the requirements in DOE 5480.21 the contractor must:

a. Provide annual reports for each facility, on a schedule corresponding to the annual update review of that facilities Authorization Basis, to appropriate RL Line Organization Division Directors summarizing USQ safety evaluations performed. This includes those USQ safety evaluations that resulted in a negative determination.

b. Perform the following actions dependent upon which of the two circumstances exist (See Figure 11-1).

   1) For discovery of an existing condition considered to be a potential USQ: ensure the facility is in a safe condition; notify appropriate RL line organization of potential USQ; upon concurrence by RL, report potential USQ using the occurrence notification process; develop and submit any documentation needed to resolve the USQ (See Figure 11-1).

   2) For a proposed change that potentially involves a USQ: ensure that the proposed change is safe; make a USQ determination; upon a positive USQ determination; submit safety analysis and new Authorization Basis to RL line organization.

RL Line Management will have a process provided to them by the Operating Contractor which will:

a. Ensure that the Authorization Basis is updated.

b. Implement the USQ process.

c. Integrate the USQ process into configuration control processes/systems.

DOE EH-13, *Training Course Handbook*, is expected to be used as a reference in reviewing and evaluating USQs.

11.5 PROCESS

It is expected that the general logic for processing a potential USQ, as presented in Figure 11-1 and Table 11-1, will be followed.

a. Line Organization Division Directors

   1) Forward a copy of the contractor's annual USQ report to the Cognizant Secretarial Officer (CSO) by submitting the report through the RL program Contracting Officer Representative to the respective DOE-Headquarters line organization office.

   2) Assuring implementation of the requirements of DOE 5480.21 and assessing the effectiveness of their implementation by fulfilling the requirements of this directive.

   3) Assuring that adequate contractor procedures are in place for facilities which the Division Director has line management responsibility.

4) Actively monitor the USQ identification, review, and decision making process of contractors under their cognizance to determine whether an incident, analysis, or proposed change/modification to systems, components, processes, operations, tests, or experiments involves an USQ. At a minimum, this shall be done by comparing a sampling of the USQ determinations listed in the annual report by the contractor against the criteria set forth in DOE 5480.21, Section 10.c. The annual list can also be used to determine trends and identify program weaknesses.

5) Actively monitor the adequacy of the contractor in implementation of requirements found in DOE 5480.21, Section 10. This shall be done on an annual basis and can be based on the contractor's annual USQ report and facility specific USQ procedure.

6) For a proposed change that involves a USQ, proceed with the following actions: (See Figure 11-1)

   a) Review the contractor's safety analysis for the proposed change to determine that the change poses an acceptable risk. The review should, at a minimum, indicate the basis for acceptance or denial of the proposal and must follow the process identified in RLP (RL Procedure) 5480.23.

   b) Submit the contractors determination of a USQ and any documentation resulting from the RL review of the contractor safety analysis to the Designated Approval Authority. Refer to RLP 5480.23 for procedure to be used for review and approval of a safety analysis.

   c) Close the USQ by obtaining approval or rejecting the proposed change.

7) For a USQ that involves a discovery of an existing condition considered to be a potential USQ, proceed with the following actions: (See Figure 11-1)

   a) If required for safety of operations, direct the contractor to curtail or suspend operations, tests, experiments, or actions to implement proposed changes/modifications pending resolution of the USQ concern, or take other actions, as appropriate, to reduce the risk.

   b) Review, in conjunction with the contractor the basis for declaring a USQ. Upon concurrence that a USQ exists or potentially exists, ensure the CSO is notified through DOE 0232.1 (current version), *Occurrence Reporting and Processing of Operations Information.*

c) Review positive USQ determinations submitted by contractor. Concurrence with the contractor's USQ determination need not generate a separate review document, but instead may be indicated by signature.

d) Notify CSO of final USQ determination through occurrence reporting process mentioned above.

e) Concur and recommend for approval to the Designated Approval Authority any justification for interim operation that is required due to a discovered inadequacy of the existing Safety Authorization Basis, or for any associated safety analysis.

f) Send the request for approval directly through line management organizations to the Designated Approval Authority for signature unless;

g) A Safety Analysis permanently changes the Safety Authorization Basis, in which case it must be reviewed per RLP 5480.23 prior to submittal to the Designated Approval Authority.

h) For immediately resolved USQ's a summary of the resolution substitutes for the safety analysis and follows the same process as shown in Exhibit 1.

Note: All safety analyses and justifications for interim operation resulting from a USQ must be approved by the Designated Approval Authority.

i) Close a USQ resulting from discovery of an inadequate Safety Authorization Basis. This is done by obtaining approval of (1) new controls needed to restrict operations to within the current Safety Authorization Basis, (2) the justification for interim operation, or (3) a new Safety Authorization Basis accepting the new risks on a permanent basis.

b. Assistant Managers. Concur and recommend for approval to the Designated Approval Authority any determination of a positive USQ, proposed change involving a USQ, and any justification for interim operation or safety analysis resulting from a USQ.

c. Designated Approval Authority. Approve documentation prepared by the contractor demonstrating compliance with DOE 5480.21. These documents are: any safety analysis developed for a proposed change that involves an USQ, any justification for interim operation or subsequent safety analysis following the

declaration of an USQ due to discovery of an existing condition, and Safety Authorization Basis documents created in compliance with DOE 5480.21.

1) Act as point of contact to identify the current Designated Approval Authority.

Figure 11-1

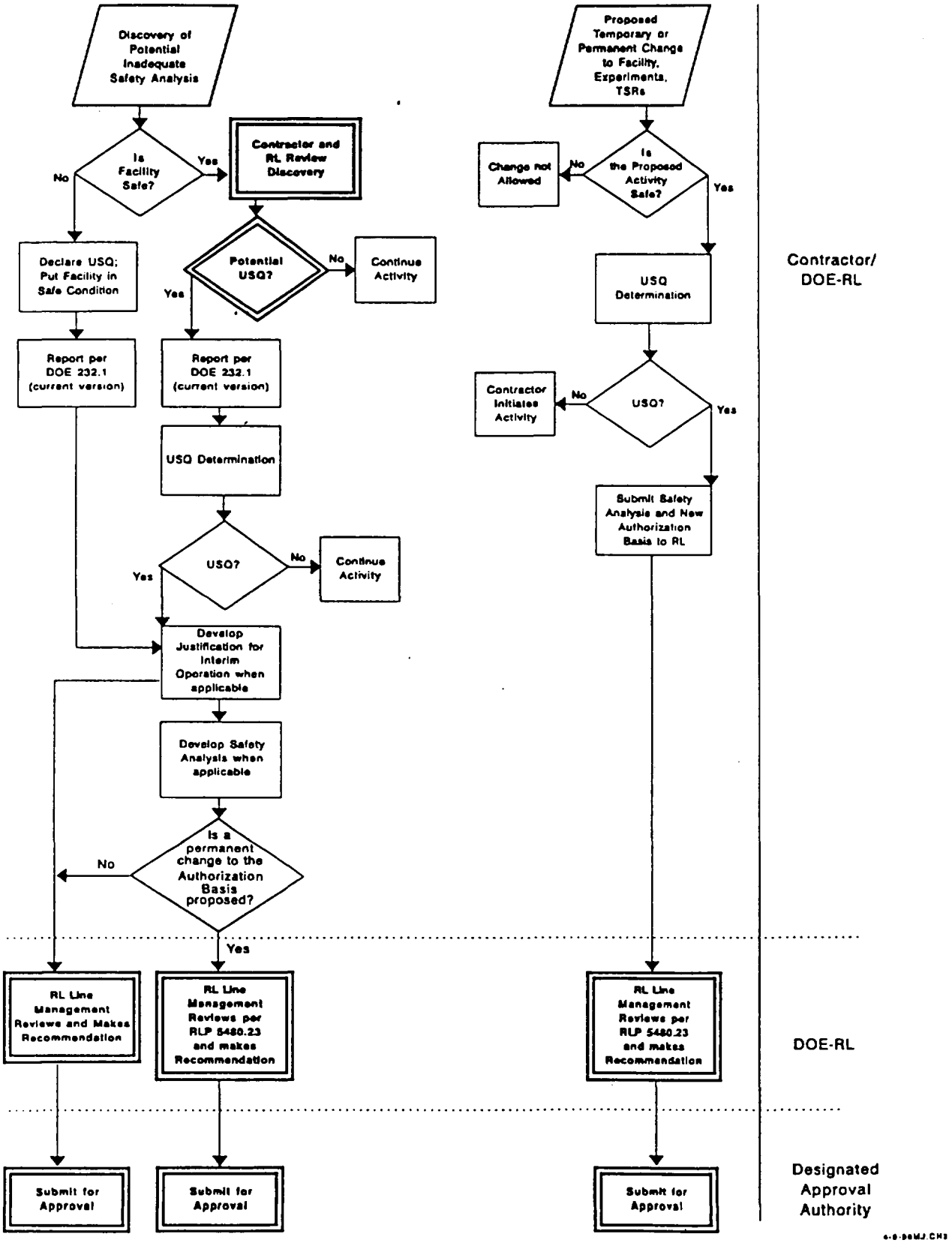

Discovery of Potential Inadequate Safety Analysis
Is Facility Safe?
No
Yes
Contractor and RL Review Discovery
Declare USQ; Put Facility in Safe Condition
Potential USQ?
No
Continue Activity
Yes
Report per DOE 232.1 (current version)
Report per DOE 232.1 (current version)
USQ Determination
USQ?
No
Continue Activity
Yes
Develop Justification for Interim Operation when applicable
Develop Safety Analysis when applicable
Is a permanent change to the Authorization Basis proposed?
No
Yes
RL Line Management Reviews and Makes Recommendation
RL Line Management Reviews per RLP 5480.23 and makes Recommendation
Submit for Approval
Submit for Approval
Proposed Temporary or Permanent Change to Facility, Experiments, TSRs
Change not Allowed
No
Is the Proposed Activity Safe?
Yes
USQ Determination
Contractor Initiates Activity
No
USQ?
Yes
Submit Safety Analysis and New Authorization Basis to RL
RL Line Management Reviews per RLP 5480.23 and makes Recommendation
Submit for Approval
Contractor/ DOE-RL
DOE-RL
Designated Approval Authority

Table 11-1. RL Review Process for USQs

	Contractor	RL Line	ESH	RL Approval Authority	HQ
USQ (TSR Change or USQ is present)	• Transmits • Works jointly with RL Line Organization on development of USQ, JIO, and final resolution	• Joint involvement in development of USQ and JIO • Review of JIO • Recommendation for approval	• Technical advice • Policy • Interpretation of requirements • Oversight as required.	Approve, if delegated; otherwise, recommend to HQ	Oversight for delegated approval authority; Approval for facilities not delegated.

12.0 AUTHORIZATION BASIS MAINTENANCE AND ANNUAL UPDATE

12.1 SCOPE

This chapter identifies existing U.S. Department of Energy (DOE) policy and expectations related to maintenance and update of facilities' authorization basis. This revision of the manual is limited to addressing the nuclear safety portions of the authorization basis.

12.2 APPLICABILITY

This chapter is applicable to all facilities that are defined as nuclear facilities (see Chapter 4), and meet one (or more) of the following:

- Upgraded portions of an old Safety Analysis Report (SAR) that were prepared to meet the requirements of DOE 5480.23;
- Any portions of older SARs that are referenced or otherwise used to fulfill the requirements of DOE 5480.23;
- Any portions of an older SAR identified by DOE as requiring annual reviews and updates on a case basis;
- Major, safety-significant modifications of existing facilities which are viewed as "new" facilities by DOE;
- Have DOE approved safety documents submitted and approved by DOE in accordance with the requirements of DOE 5480.23, including basis for interim operations, interim safety basis, SARs, preliminary SARs, final SARs, operational safety requirements, technical safety requirements;
- Portions of older SARs that have been effected by DOE approval of changes or conditions in accordance with the Unreviewed Safety Question (USQ) process.

12.3 EXISTING POLICY

12.3.1 Existing Requirements

a. DOE 5480.23, *Safety Analysis Reports.*

b. DOE 5480.21, *Unreviewed Safety Question.*

12.3.2 Existing Guidance

a. DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23.*

12.4 EXPECTATION

There should be no changes to a nuclear facility Safety Authorization Basis (SAB) that have not gone through the USQ process. As a result of the USQ process, those changes, whether proposed or as found conditions, or due to an inadequate SAB, will either require DOE approval or allow contractor approval. Upon proper approval they become part of the SAB and must be incorporated into appropriate controlled documents.

The contractor is allowed to modify safety documents during the year, without waiting for the annual update (see Chapter 11). These modifications must have gone through the USQ process. DOE allows the contractor to submit the changes to DOE on an annual basis; however, this is only allowed if the changes are maintained as part of the Nuclear SAB until the annual update.

On an annual basis the contractor is required to review the existing SAB to verify that it still represents the operational envelope for that facility and adequately identifies the risks present. As part of this annual review the contractor should notify the Richland Operations Office (RL) of the review results and is required to provide RL with an identification of any SAB changes performed throughout the year or during the annual update.

Contractors are expected to ensure that copies of the SAR in circulation are up to date. Contractors are obligated by the Order to implement a formal mechanism to ensure that SARs contain reliable information, that SARs are updated as necessary to sustain reliability, and that the circulation of amendments, revisions, updates, packages of replacement pages, or new SARs is sufficiently controlled that users throughout DOE and the contractors organization have access to the most recent edition.

Annual update anniversaries should be based on DOE approval dates. Annual updates should be proposed by the contractor, agreed to by RL, and be included in the contractor's overall scheduling process.

DOE 5480.23 requires that annual updates be submitted to the Program Secretary Officer. DOE-Headquarters delegation of approval authority to RL includes this function - i.e., annual updates should be submitted to the RL approval authority as identified in the RL Authorities and Responsibilities Manual to satisfy the requirements of DOE 5480.23.

12.5 PROCESS

None applicable.

13.0 EXTENDED SURVEILLANCE AND TRANSITION TO DECONTAMINATION AND DECOMMISSIONING (D&D)

13.1 SCOPE

This chapter documents the ground rules regarding the manner of addressing the authorization basis for transition facilities which includes the Safety Analysis Report (SAR), Basis for Interim Operation, Interim Safety Basis (ISB), and Technical Safety Requirements (TSRs)/Operational Safety Requirements (OSR) as applicable. It needs to be emphasized that the orderly suspension or rescinding of the SAR or ISB for the major transition facilities is a primary goal of this program and transition phase.

13.2 APPLICABILITY

Facilities that no longer have a mission beyond eventual D&D. This includes facilities that have been stabilized and deactivated, to a safe, low maintenance surveillance state, and nuclear facilities that have been in standby or have most recently concluded their mission and are no longer operational.

13.3 EXISTING POLICY

13.3.1 Existing Requirements

a. DOE 5480.22, *Technical Safety Requirements*

b. DOE 5480.23, *Safety Analysis Reports*

13.3.2 Existing Guidance

a. DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Safety Analysis Reports*

b. DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*

13.4 EXPECTATIONS

The transition facilities that are entering this phase of life are still governed by a SAR or similar authorization documentation which is maintained by the contractor.

The SAR remains a major element in the nuclear safety authorization basis throughout the transition phase and is an integral part of the transition process.

The facilities are still subject to all Technical Specifications (TSs), OSRs, TSRs, and other restrictions as appropriate until such time as hazards are removed and the associated accident analyses (DOE 5480.23) are no longer relevant.

The analysis, system descriptions and other governing parameters can be formally relaxed and/or deleted by amendment as appropriate. This can only be done using the USQ process (refer to Chapter 11). This process is utilized to ensure the deletions are adequately analyzed and properly approved, and that no unidentified issues or hazards have been created as a result of the deletion.

Where a change in the operation may present a new hazard and the analysis shows added restrictions are necessary, a modified or new TS/OSR/TSR is derived and the normal review cycle, which incudes DOE, is implemented.

It should be recognized that many tasks and activities in this phase of deactivation are governed by limits and conditions in the SAR which are routine and utilize SAR governing or implementing procedures.

13.5 PROCESS

There is no unique or singular processes for facilities in transition or extended surveillance and maintenance. The processes defined in other manual chapters such as Generic Review and Approval (Chapter 8), USQ (Chapter 11), and Authorization Basis Maintenance and Annual Update (Chapter 12) provide the information needed to maintain and change the existing nuclear safety authorization basis for these facilities. The chapter on Hazard Categorization (Chapter 4) describes the process used to change the facility categorization.

14.0 EXEMPTIONS

[RESERVED]

15.0 PRICE-ANDERSON AMENDMENT ACT

[RESERVED]

16.0 NUCLEAR REQUIREMENT TOPICAL DISCUSSIONS

16.A HUMAN FACTORS SAFETY ANALYSIS (HFSA)

16.A.1 SCOPE

The topic of human factors is mandated by DOE 5480.23 Safety Analysis Reports (SARs) and must be included as part of the SAR. HFSA should cover all activities of personnel at the facility that could cause or exacerbate hazards, or where hazards may exist.

16.A.2 APPLICABILITY

Human Factors covers all activities of personnel operating or maintaining a facility and includes all potential human errors that can lead to or fail to mitigate an occurrence. This activity may include consideration of design decisions such as function allocation to man, machine or to operation of the facility. Specifically, tasks performed by personnel, and the equipment they use in performing these tasks must be considered in accordance with DOE 5480.23.

16.A.3 EXISTING POLICY

16.A.3.1 DOE Policy

16.A.3.1.1 DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy, Nonnuclear Nuclear Facility Safety Analysis Reports, provides guidance for the preparation of hazards and accident analyses as the primary component of the safety analysis report to ensure compliance with DOE Order 5480.23.

16.A.3.1.2 DOE-5480.23 Nuclear Safety Analysis Reports. This order provides the requirements to includes human factors safety in the analysis of DOE Nuclear Facilities.

16.A.3.2 Other Standards

16.A.3.2.1 IEEE-STD-1023 Human Factors Engineering Requirements.... This standard provides the framework for design and analysis of human factors engineering aspects of nuclear facilities.

16.A.3.2.2 MIL-STD-1472, Human Engineering Design Criteria for military, equipment, systems and Facilities. This Standard provides the most extensive set of good practices and design criteria for human-machine interface design.

16.A.3.2.3 NUREG 0700, Guidelines for Control Room Design Reviews, provides a set of tailored human engineering good practices and design criteria for nuclear control rooms.

16.A.4 EXPECTATIONS

Human Performance failures with severe consequences should be identified in order to assess the risk of these failure. Task analysis, design evaluation and risk assessment are done together to provide the basis for managing risk due to human error or failure to mitigate the impact of other occurrences. Analysis should address man-machine interfaces, probability and consequence of human error, and human activity during emergency operations as applicable.

16.A.5 PROCESS HFSA

Human error is pervasive in most events in engineered systems; the Federal Aviation Administration reports pilot error in about 65% of it's accidents, the NRC shows a similar percentage of its Licensed event reports, and ORPS data cites human error as a cause in two out of every three occurrences. In fact, human error is universally present in major man made catastrophic events. By including HFSA in facility SAR, DOE 5480.23 took the step to require looking at the causes of human error in DOE facilities and determining whether they create a significant risk to safety and health.

If one wants to consider human factors safety in the assessment of facility safety, one has to consider that human errors are caused when operators are operating (performing tasks) facility equipment (design) that has some degree of risk. Therefore, to properly do HFSA one must consider what tasks people will be doing, the equipment they will be operating and the consequences of failure as shown in Figure 16.A.1.

For HFSA, the task analysis first looks at Operator information needs. Decisions and actions are determined with Task analysis, and these actions are considered against human capabilities. Task analysis for HFSA should consider what errors are possible, then look at the task complexity, task difficulty and the conditions under which the task is performed.

During HFSA, the human-machine interface design should be evaluated against good design practices found in performance based human factors engineering design criteria (e.g. MIL-STD-1472 or DOE STD 1102) to determine if there are any design factors (controls, displays, positioning etc.) which violate these good practices. If so, the consequence of error due to design factor violations should be considered. These consequences are evaluated against what the operators will be doing with the design factors (task analysis) to assess the risk of the task/design combination.

HFSA for New Systems: For new systems, the HFSA is an integral part of the design process as illustrated in Figure 16.A.2. During design, functions are allocated to manual(human) operation, machine (automatic) operation, or some combination of man or machine control based on trade-off factors such as safety, performance, or cost. Once the human functions are identified, the design process considers how these functions should be performed by the operators (task analysis). This task analysis provides information relative to information needed (displays), actions that need to be taken (controls), and the sequence of the actions for layout of equipment. This information is translated into preliminary design, the tasks are analyzed in more detail, and design is modified to correct any problems encountered in the analyzed operation. This process continues until detail design is complete. During this process, some tasks may be found to be critical to operation or safety and a decision is made to further analyze these tasks to assess the risk to operations, environment, safety or health (risk assessment). Human Factors risk assessment needs to consider the probability of human error, the consequence of human error, and any factors that will contribute to the risk or diminish the risk. This approach is self grading since extensive risk assessment is only performed when a problem is apparent, although; human activity during emergency operations should always be assessed.

The HFSA input into the preliminary SAR should include the task analysis data for these tasks, an evaluation of the equipment or work space involved in performing these tasks and the evaluation of the risk.

HFSA for Existing Systems. For existing systems, HFSA is intimately tied to the hazards analysis and the facility Final SAR (FSAR). The same three human factors elements, task analysis, human-machine interface design and risk assessment of operator behavior, are included. However, there is a choice in the approach to HFSA for existing facilities, which is based on how well the HFSA is tied into the other activities of the SAR.

Option 1 first considers the human-machine interface in the existing facility against an accepted design criteria (MIL-STD-1472). Frequently, a survey of the human-machine interface is done using extensive checklists, based on existing standards, which allow consideration of the design aspects. If violations are found in this survey, all tasks that use the equipment found in violation are analyzed to assess the probability of that equipment causing an error, the resulting consequences, and the risk of the error. This is the method selected by the Nuclear Regulatory Commission to evaluate control rooms after Three Mile Island. This method has the value that it can be done at any time, independent of any other safety analysis going on. It is also a comprehensive survey of the human-machine interface design and tasks associated with poorly designed equipment. It is not strong in assessing the impact of poor job design as it grades out all tasks that are not associated with poorly designed equipment.

The alternative option is to do a task analysis of all operator tasks, evaluating the task complexity and difficulty, and the consequences of error in performing the task. This should

consider the design aspects of the human-machine interface equipment used to perform those tasks for which there is concern. This method evaluates the behavior of the operator, and only considers design aspects later. It is more comprehensive; but, because task analysis is work intensive, this tends to be an expensive method. One way to use the graded approach with this method is to concentrate on the hazard scenarios generated by the hazards analysis, and only analyze design basis accidents as illustrated in Figure 16.A.3. In all cases, tasks of all emergency procedures are assessed.

The FSAR information for HFSA would include the task analysis data for these tasks, an evaluation of the equipment or work space involved in performing these tasks and the evaluation of the risk.

Other Considerations DOE 5480.23 specifically mentions human reliability analysis (HRA) as an appropriate method to do HFSA. While HRA is a powerful tool for HFSA risk assessment, it is difficult to use and should be used primarily when there is the potential for relatively severe consequences or Hazard Category 1 facilities. Other methods of risk assessment are acceptable.

There is a requirement for performing a safety analysis considering human factor, in 29 CFR 1910.119. This approach would also satisfy that requirement.

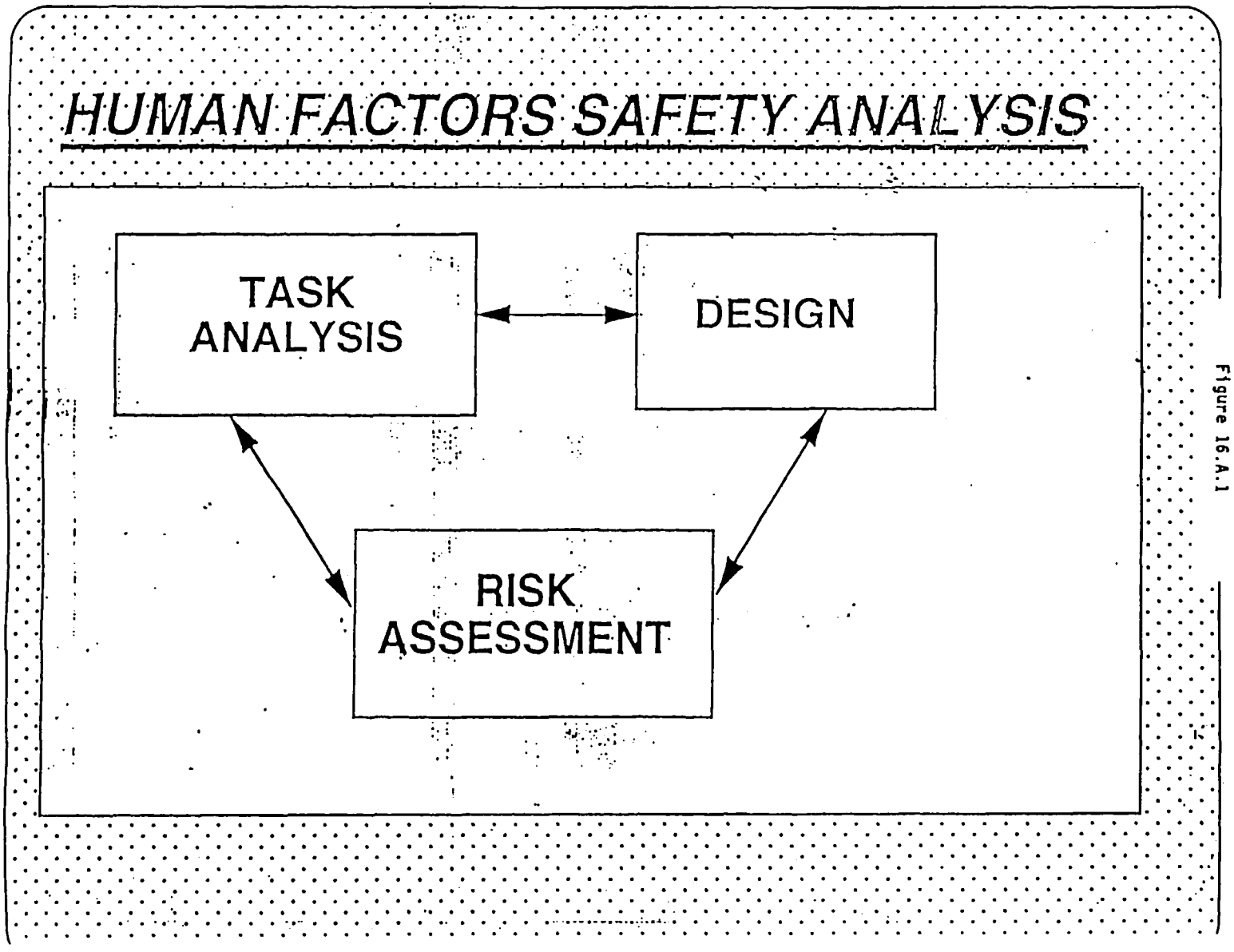
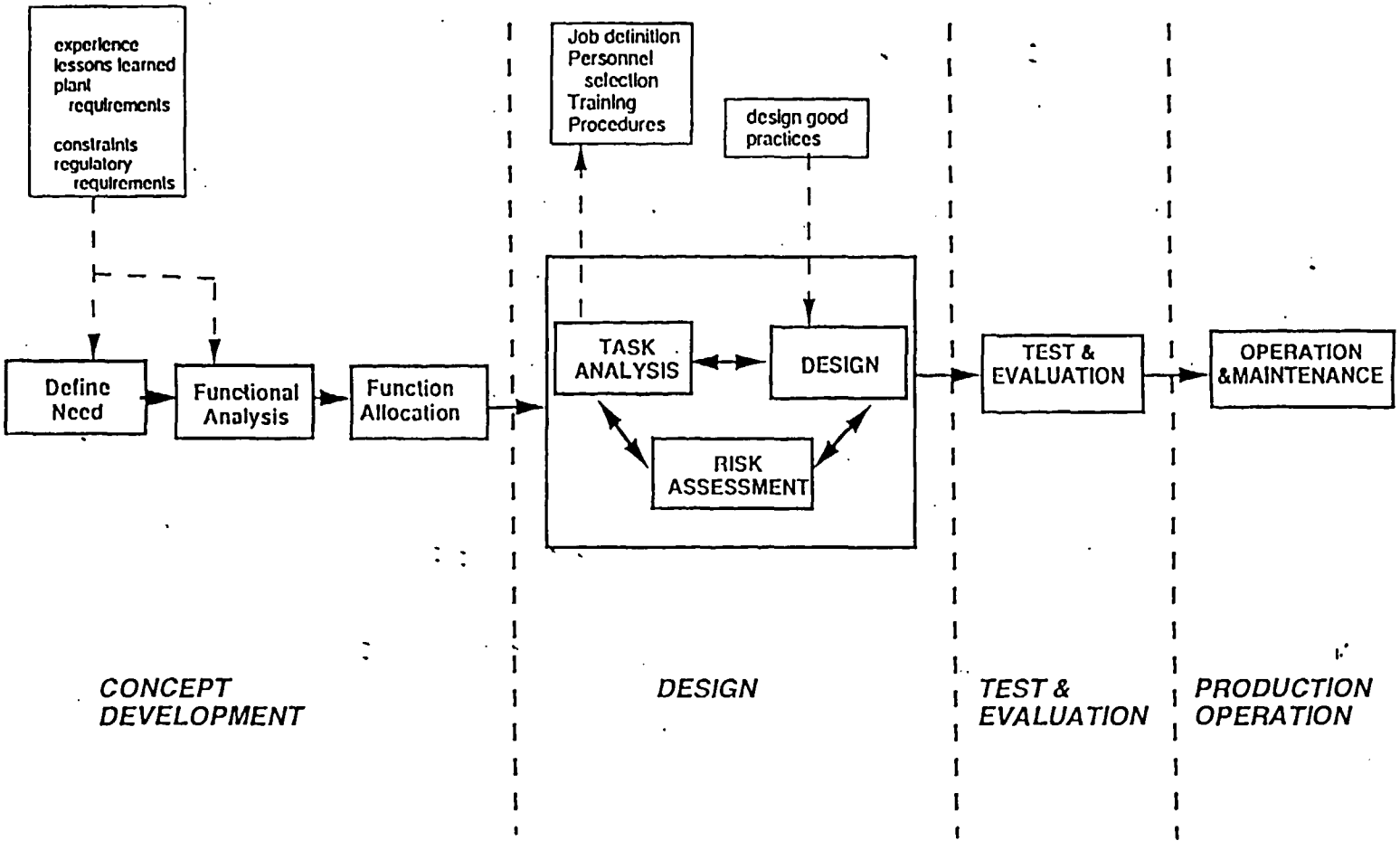

HUMAN FACTORS SAFETY ANALYSIS
TASK ANALYSIS
DESIGN
RISK ASSESSMENT

Figure 16.A.1

Figure 16.A.2

NEW SYSTEMS



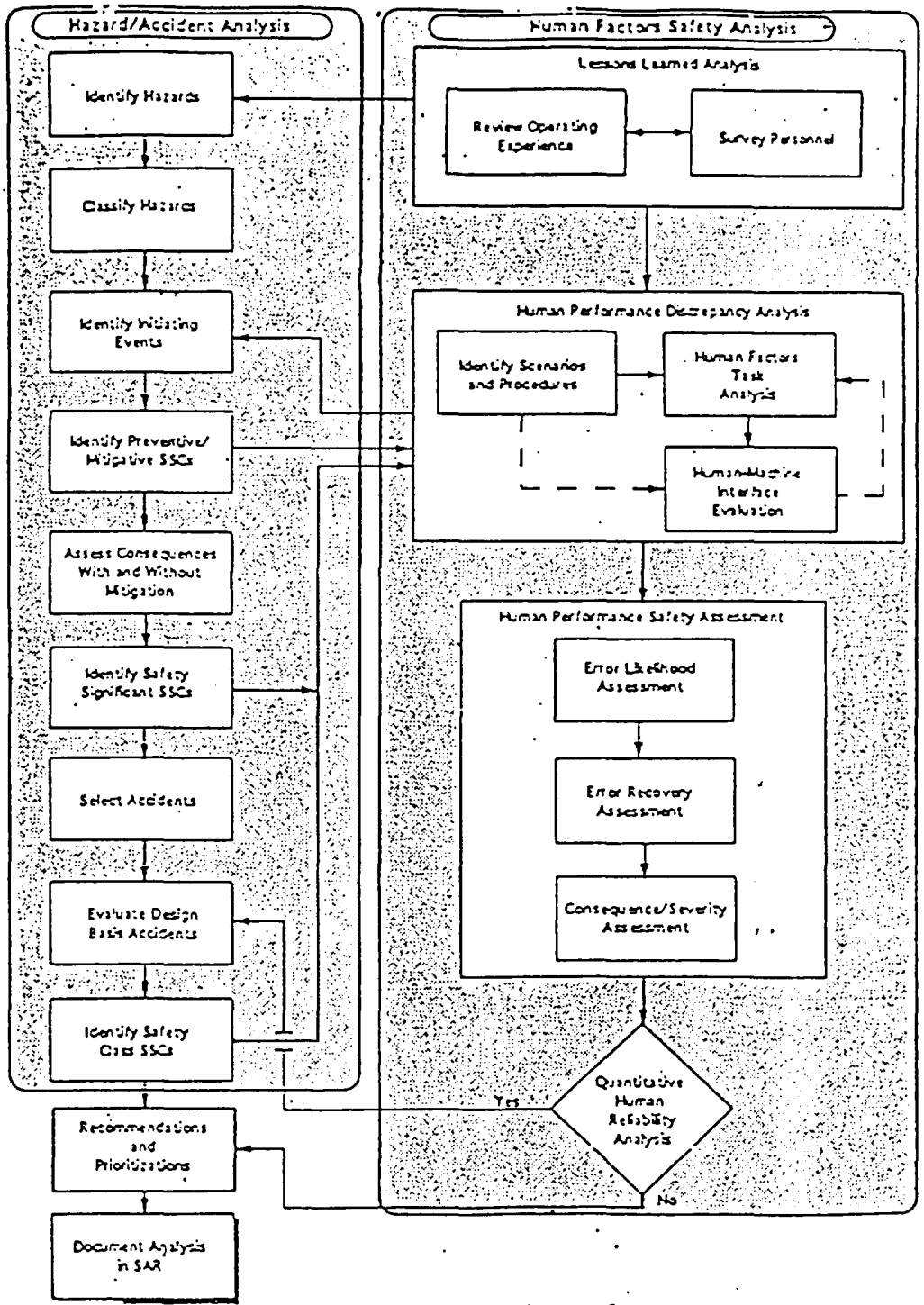


Figure 16.A.3 Human Factors Safety Analysis for Existing Facilities

16.B GRADED APPROACH

16.B.1 SCOPE

This chapter establishes the principals behind application of a graded approach in the level of analysis and documentation required to support performance of a safety analysis for a given facility or activity.

16.B.2 APPLICABILITY

This applies to nuclear safety documents for all nuclear facilities, and includes documents such as Safety Analysis Reports (SARs) and Basis for Interim Operations (BIO). The graded approach is not applicable to decreasing the topical areas to be discussed but rather the depth of the discussion within each topic.

16.B.3 EXISTING POLICY

16.B.3.1 Existing Requirements

a. DOE 5480.23, *Safety Analysis Reports.*

16.B.3.2 Existing Guidance

a. DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Safety Analysis Reports.*

b. DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans.* This provides guidance in development of BIOs.

16.B.4 EXPECTATIONS

The breadth of discussion in each type of safety document is not subject to gradation but rather the depth of that discussion. For example a facility SAR compliant with DOE 5480.23 should include a discussion on each of the 21 topical areas listed in section 8.b of that Order; however, the SAR may state that the section on criticality is not applicable because there is no fissionable material in the facility. Alternatively, a storage facility with automated controls and minor human interaction may not need an in depth human factors analysis due to the limited human machine interface in that type of facility.

This is also applicable to BIOs, which should include the breadth of discussion required by DOE-STD-3011-94. However, the guidance found in that standard identifies the graded approach as a viable method to develop a BIO.

Applicability of institutional programs or controls may vary depending upon the types of hazards present and the operations occurring within the facility. Although some discussion is required for institutional programs, only those institutional programs or controls relied upon to control or minimize hazards/risks specific to that facility need be discussed in depth. For example the existence of a fire protection program should be identified and credited. If there is a specific hazard/accident, with otherwise unacceptable consequences, that is prevented or mitigated by that program then its action should be identified and discussed in detail. If no specific control exists then no further discussion beyond acknowledgement of the existence of a fire safety program is required.

There are requirements that are not subject to application of a graded approach. The requirements, if applicable to the facility in whole or in part, are invariant and must be invoked at the level specified in the governing Rule or Order. The four sections that fall into this category are:

1) Radioactive/Hazardous Material Waste Management
2) Inadvertent Criticality Protection
3) Radiation Protection
4) Hazardous Material Protection

There is also no gradation of the logic flow used in development of safety documents. There must be a clear connection presented in the safety analysis from the existing hazards to the controls imposed. There is allowed variance in application of types of safety analyses used (qualitative vs quantitative).

Attachment 16.1.1 to this manual presents an expanded discussion of the Graded Approach.

Chapter 5, Hazard Analysis, discusses application of the graded approach for hazards analysis.

16.B.5 PROCESS

There is no specific process for graded approach. The generic review and approval process (Chapter 8) is equally applicable to documents that have invoked a graded approach.

ATTACHMENT 16.1.1

THE GRADED APPROACH APPLIED TO SAFETY ANALYSES

GRADATION CRITERIA:

Reference DOE 5480.23, Section 8.a. The following criteria are used to establish a graded approach in the level of analyses and documentation required to support performance of a safety analysis for a given facility or activity.

a. The magnitude of the hazards associated with the facility/activity, or with an individual accident class/abnormal operation being evaluated for the given facility/activity.

b. The complexity of both a facility/activity and the protective features used to reduce the risk of the facility/activity to an acceptable level. These protective features can fall into one of two categories:

   1) Operator Action

   2) Engineered Safety Features

   3) The life cycle stage of the facility/activity for which DOE approval of the associated Safety analysis report is being sought.

SAR required content:

Reference DOE 5480.23, Section 8.b and DOE 5480.23, Attachment 1, Section 3.f.(2).(a). The minimum content requirements for SARs are specified in general terms below.

a. Definition of the safety basis for the facility/activity. The safety basis is defined in DOE 5480.23, as that combination of information relating to the control of hazards at a nuclear facility upon which DOE depends for its conclusion that activities at the facility can be conducted safely.

   Note that material relating to the definition of the safety basis that is required to be submitted under the terms of other Nuclear Safety Orders may be contained in the SAR, summarized in the SAR, or incorporated by reference and included in the controlled distribution of the SAR.

b. Documentation of the logic used to derive the safety basis. The safety basis is generally arrived at through:

   1) Consideration of generic constraints, contractor practices and policies, commercial nuclear industry practices and applicable nationally recognized codes/standards.

   2) Engineering judgement.

   3) Accident and other types of engineering analyses (including human factor safety analysis).

The derivation of the safety basis is reviewed to determine its adequacy for the facility/activity. The derivation of the safety basis is also used to evaluate future proposed changes or new information relating to the facility/activity.

Demonstration that adherence to the safety basis will ensure nuclear safety rules and other requirements of the department are met. This will include any analyses or discussion required to show that operation anywhere within the permitted facility conditions or activities will satisfy those constraints imposed by statutes and directives.

Justification of the adequacy of the safety basis with respect to protecting the health and safety of occupational workers, the public, and the environment. This will include analyses of normal releases, incidents and accidents. A continuous spectrum of scenarios should be evaluated to identify the dominant risk contributor. Where a representative set of limiting accidents is used for this evaluation, sufficient information should be provided to show that the set of limiting accidents that were selected are actually representative with no important omissions. Failure mechanisms to be considered in this evaluation include:

a. Process component failures

b. External events

c. Human errors

d. Institutional controls

The Safety Analysis Report shall also include thorough documentation of all assumptions used in performing the safety analysis.

Safety Analysis Report outline of required topics:

Reference DOE 5480.23, Section 8.b. The minimum general content requirements specified in the section above are incorporated by addressing the following topics in the Safety Analysis Report. All topics may not be applicable for a given facility or activity. In that case, the inapplicability must be justified under the associated topic.

1) Executive Summary

2) Applicable Statutes, Rules and Departmental Orders

3) Site Characteristics

4) Facility Description and Operations

5) Hazard Analysis and Classification

6) Principal Health and Safety Criteria

7) Radioactive and Hazardous Waste Management

8) Inadvertent Criticality Protection

9) Radiation Protection

10) Hazardous Material Protection

11) Analysis of Normal, Abnormal and Accident Operations

12) Management, Organization and Institutional Safety Provisions

13) Procedures and Training

14) Human Factors

15) Initial Testing, In-Service Surveillance and Maintenance

16) Derivation of Technical Safety Requirements

17) Operational Safety (Conduct of Operations)

18) Quality Assurance

19) Emergency Preparedness

20) Decontamination and Decommissioning

Note that the topic specified in DOE 5480.23, Section 8.b.(3).(u): Applicable Facility Design Codes and Standards has been incorporated under the Principal Health and Safety Criteria section. This is in agreement with DOE 5480.23, Attachment 1, Section 3.f: Scope and content of Safety Analysis Reports.
Application of the graded approach criteria to the required Safety Analysis Report content by outline topic:

The following discussion provides a general approach to application of the three gradation criteria to safety analyses and the associated topics required to be addressed in the SAR. This general approach is based on utilization of the gradation criteria within the context of the actual purpose of the specific topic within the SAR. SAR topics can be divided into three types by their purpose:

A) Sections that discuss requirements established by Rules and Orders that, if applicable in whole or in part for the given facility/activity, are invariant.

B) Sections that support establishing the Hazard Categorization of the facility/activity being evaluated.

C) Sections that establish protective features used to reduce the risk associated with hazards identified at the facility/activity to levels that are acceptable to the department.

The basis for application of the graded approach in safety analyses differs for each type.

Application of the graded approach to those sections that relate invariant requirements associated with the facility/activity is not appropriate. An example of this would be the radiation protection section that relates the controls applicable to the facility/activity established through DOE 5480.11.

Application of the graded approach in analyses related to hazard identification and categorization will be limited to consideration of the type of analyses to be performed based on the complexity of the facility/activity being evaluated. These analyses are used

to identify and establish the magnitude of the hazards associated with the facility/activity. Therefore, reduction of the scope of analyses or evaluations performed based on the three graded approach criteria is not appropriate. Material presented in the associated sections of the SAR should agree with the content and level of detail specified by DOE 5480.23. This will ensure sufficient information is provided to determine both the accuracy and adequacy of the Hazard Analyses and Categorization.

The sections in the remaining category are used to establish any additional safety basis required to reduce the risk associated with the facility/activity to an acceptable level. Once the hazards associated with the facility or activity have been adequately defined, application of the graded approach to these sections of the Safety Analysis/SAR using all three criteria specified in DOE 5480.23 is appropriate.

This approach is discussed by type for each required topic of the Safety Analysis Report below.

Type A: Invariant Requirement Sections

These sections discuss requirements that are established by Rules or Orders. The requirements, if applicable to the facility in whole or in part, are invariant and must be invoked in the safety analysis and associated sections of the SAR at the level specified in the governing Rule or Order. Four sections of the SAR fall in this category:

1) Radioactive/Hazardous Material Waste Management

2) Inadvertent Criticality Protection

3) Radiation Protection

4) Hazardous Material Protection

For example, the primary documents governing inadvertent criticality protection include 10 CFR 72.124, American National Standards/American National Standards Institute 8.1, various DOE Orders and NRC Regulatory Guides. The primary documents for radiation protection include 10 CFR 20, DOE 5400.5 and 5480.11, and various NRC Regulatory Guides. The primary documents governing hazardous material protection include 29 CFR 1910, 29 CFR 1926, and various DOE Orders. Waste management is governed by the 40 CFR 26x series of Federal Regulations, State Regulations, and various DOE Orders. The requirements of the applicable portion of these documents must be established in the associated sections of the SAR.

Note that the above tabulation of governing documents is not comprehensive for the various sections. The intent is to provide examples of the types of Rules and Orders that impose invariant requirements upon a facility or activity.

Type B: Hazard Categorization Sections

This portion of the safety analysis is associated with the facility/activity hazard analysis and classification process. Three sections of the safety analysis report fall in this type:

1) Site Characteristics

2) Facility Description and Operation

3) Hazard Analysis and Classification of the Facility

Background information required to support the safety analysis includes site characteristics, a description of the facility/activity, and a description of the operations associated with the facility/activity. This information should be provided with sufficient detail and depth to perform the hazard analysis and support the development of any required additional safety bases. The associated sections of the SAR should provide enough information to allow determination of both the accuracy and adequacy of the Hazard Analyses and Categorization. The Site Characteristics section should be limited to a discussion of the area that either could be affected by hazards associated with the facility/activity or could introduce hazards at the facility/activity. The facility/activity description and discussion of operations will provide sufficient information to support determination the adequacy of both the hazard analysis and the safety basis established in other sections of the SAR.

Application of the graded approach in performance of the hazard analysis will be limited to consideration of the type of analysis methods to be used. This consideration will be based on the complexity of the facility/activity being evaluated. For example, a complex facility may require more elaborate methods to be used in identification of hazards, hazardous material release mechanisms and release energies available in the facility/activity. Determination of the hazard potential of abnormal operations or accidents may also require the use of more elaborate mathematical tools than those needed for a less complex facility/activity.

The content of the Hazard Analysis and Classification section of the SAR should include the results of the hazard analysis that was performed for each major type of hazard associated with the facility/activity. This section will also include a Hazard Categorization for each major type of hazard and the overall hazard categorization derived for the facility/activity. Sufficient supporting information should be provided to allow evaluation of the accuracy and adequacy of the hazard analyses and categorizations.

Type C: Additional Safety Bases

This portion of the safety analysis further develops the safety basis established by the hazard analysis. The sections of the SAR associated with this portion of the safety analysis present information related to the control of hazards identified with the facility/activity.
These controls establish protective features that are necessary to reduce the risk of operations at the facility/activity to a level that is acceptable to the department. Sections of the Safety Analysis Report contained in this type include:

1) Principal Health and Safety Criteria

2) Analysis of Normal, Abnormal and Accident Operations

3) Management, Organization and Institutional Safety Provisions

4) Procedures and Training

5) Human Factors

6) Operational Safety (conduct of operations)

7) Initial Testing, In-Service Surveillance and Maintenance

8) Derivation of Technical Safety Requirements

9) Quality Assurance

10) Emergency Preparedness

11) Decontamination and Decommissioning

The applicability of these topics will vary between facilities/activities depending on the actual operations involved and the hazards identified with those operations. Applicability will also depend on the nature of the protective features established at any given facility/activity. Use of the graded approach in this portion of the safety analysis based on all three criteria is appropriate in determining the level of development required for these sections at a specific facility/activity.

The Principal Health and Safety Criteria analysis consists of an evaluation of the safety requirements applicable to facility structures, systems, components, equipment and processes. These criteria are generally established through reference to published codes and standards. The scope of this evaluation is limited to those portions of the facility or activity that support safety functions or are safety significant. The depth of this evaluation should be graded against the severity of the hazard associated with the facility or portion of the facility being evaluated. The

number of systems or components that provide a safety function at the facility, or for a portion of the facility, would be expected to increase as the hazard severity associated with it increased. If the hazard analysis for the facility or activity resulted in a Category 3 Hazard Classification, few systems or components would be required to support a safety function, reducing the depth of evaluation required. Only an amount of material sufficient to present and evaluate the appropriateness of the principal safety criteria should be presented in the Safety Analysis Report.

Operating condition and accident analyses are used in the safety analysis process to develop an objective basis for verifying the adequacy of facility/activity preventive or mitigative features provided to reduce the risk of operation to an acceptable level. The analyses are intended to show that protective measures are adequate during all modes of operation to ensure the health and safety of facility workers, other workers on the DOE reservation, the general public both on and off the DOE reservation, and the environment. Operating condition analyses are based on information developed in previous sections of the safety analysis relating to the hazards associated with, and the principal health and safety criteria established for the facility/activity.

The operating condition and accident analysis methods used, required level of evaluation, and range of conditions analyzed will depend both on the hazard level and complexity of the facility/activity. The safety analysis report for a Hazard Category 3 facility/activity should provide a quantitative analysis of the consequence of both normal and accident conditions bounding for different classes of accidents. Qualitative analyses of accident conditions contained within a class of accidents and severe accidents should be provided to supplement the quantitative analyses.

Two sections of the safety analysis are used to establish minimum levels of control for facility/activity components that are used to provide protective features. These sections are:

Initial Testing, In-Service Surveillance and Maintenance

Quality Assurance (QA) (system hardware control portions)

The analyses and level of evaluation required will depend on the nature of the protective features used to reduce the risk associated with the facility/activity to an acceptable level. If the facility/activity safety functions required to reduce the risk of operations to an acceptable level are provided through the use of both passive and active engineered safety features, analyses will be required to show that these protective features are adequately established and maintained. The depth of analysis presented in the associated sections of the SAR will depend on the severity of the hazard being controlled and the complexity of the equipment providing the protective function. Presentation in the SAR should be limited to those features that either provide a safety function or are safety significant.

Five sections of the safety analysis are used to establish any required institutional protective features. These sections are:

Management, Organization and Institutional Safety Provisions

Procedures and Training

Human Factors

QA (institutional control portions)

Operational Safety (conduct of operations)

The analyses and level of evaluation required will depend on the nature of the protective features used to reduce the risk associated with the facility/activity to an acceptable level. If facility/activity safety functions are provided through personnel actions rather than through the use of engineered safety features, then a significant level of analysis will be required to adequately establish these institutional protective features.

17.0 ACRONYMS AND DEFINITIONS

17.1 ACRONYMS

AEA Atomic Energy Act
AM Assistant Manager
ANS/ANSI American National Standards/American National Standards Institute
BHI Bechtel Hanford, Inc.
BIO Basis for Interim Operation
CCA Cause/Consequence Analysis
CD Cognizant Division
CERCLA Comprehensive Environmental Response/Compensation and Liability Act.
CFR Code of Federal Regulations
CSO Departmental Cognizant Secretarial Officer
D&D Decontamination and Decommissioning
DOE U.S. Department of Energy
DOL Department of Labor
EH Office of Environment, Safety and Health (HQ)
EIS Environmental Impact Statement
EM Assistant Secretary for Environmental Management
EPA
ESH Office of Environmental, Safety and Health
ES&H Environment, Safety and Health (subject)
ET Event Tree
FMEA Failure Modes and Effects Analysis
FSAR Final Safety Analysis Report
FT Fault Tree
FYPP Fiscal Year Program Plan
FYWP Fiscal Year Work Plan
HA Hazards Analysis
HAZOP Hazard and Operability Analysis
HQ U.S. Department of Energy-Headquarters
HRA Human Reliability Analysis
IP Implementation Plan
IPRT Implementation Plan Review Team
ISB Interim Safety Basis
JCO Justification for Continued Operation
JIO Justification for Interim Operation
M&I Management and Integration
M&O Management and Operating
MOU Memorandum of Understanding
MYPP Multi-Year Program Plan
NEPA National Environmental Protection Act

NRC Nuclear Regulatory Commission
NSAB Nuclear Safety Authorization Basis
NSMM Nuclear Safety Management Manual
OSH Occupational Safety and Health Act
OSHA Occupational Safety and Health Administration
OSR Operational Safety Requirements
P&ID Process and Identification Drawings
PAAA Price-Anderson Amendments Act of 1988
PHA Preliminary Hazards Analysis
PRA Probabilistic Risk Assessment
PSAR Preliminary Safety Analysis Report
QA Quality Assurance
QSH RL Quality, Safety, and Health Programs Division
RCRA Resources Conservation and Recovery Act of 1976
RIDs Requirements Identification Documents
RISG Rule Implementation Steering Group
RL U.S. Department of Energy, Richland Operations Office
RLP RL Procedure
SA Safety Analysis
SAB Safety Authorization Basis
SAR Safety Analysis Report
SEN Secretary of Energy Notice
SER Safety Evaluation Report
TS Technical Specifications
TSR Technical Safety Requirements
USC United States Codes
USQ Unreviewed Safety Question
WHC Westinghouse Hanford Company

17.2 DEFINITIONS

Terms defined in this glossary will appear in initial capitalized type throughout all definitions.

1. Accident Categories

   a. Likely Accidents An off-normal condition that may be expected to occur at least once during the lifetime of a Facility having a nominal range of annual frequency between 10^{0} to 10^{-2}.

   b. Unlikely Accident A condition not expected to occur during a lifetime of a Facility having a nominal range to annual frequency between 10^{-2} to 10^{-4}.

c. Extremely Unlikely Accident A condition that represents an extreme or limiting case of faults identified as possible at a Facility having a nominal range of annual frequency between 10^{-4} to 10^{-6}.

d. Incredible Accident A condition for which no credible scenario can be identified and is considered to be a Beyond Design Basis Accident for a Facility having a nominal annual frequency of less than 10^{-6}.

2. Administrative Controls (AC) Provisions relating to organization and management, procedures, recordkeeping, assessment, auditing, safety programs, and reporting necessary to ensure safe operation of a Facility.

3. As Low As Reasonable Achievable (ALARA) An approach to radiation protection and industrial hygiene to control or manage radiation and chemical exposures (both individual and collective to the work force and general public) as low as sound technical, economic, practical, social, and public policy considerations permit. As used in this document, ALARA is not an exposure limit, but a process which has the objective of keeping exposure levels as far below applicable limits of the Orders as reasonably achievable.

4. Auditable Safety Analysis A documented and controlled compilation of safety information equivalent to that required in a Safety Analysis Report which can be examined and evaluated by an independent group to determine that activities at a given Facility can be and are being conducted safely.

5. Common Cause Failure Failure of more than one component of a system initiated by the same event or sequence of events.

6. Implementation Plans (IPs) A DOE-approved plan and schedule for attaining compliance with applicable codes, regulations, and Orders.

7. Controlled Document A document wherein the content is maintained uniform among the copies by an administrative control system.

8. Cost Benefit An evaluation of the cost of a proposed change associated with the derived safety improvement. This is applied to both normal (e.g., ALARA application) and abnormal and accident conditions (e.g., for determining Structures, Systems, and Components Important to Safety that must be provided).

9. Design Basis The set of requirements that bound the design of systems, structures, and components within the Facility. These design requirements include consideration of safety, plant availability, efficiency, reliability, and maintainability. Some aspects of the Design Basis are important to safety, although others are not.

10. Design Basis Accidents (DBAs) Accidents that are considered credible enough to be postulated for the purpose of establishing design and performance requirements for the Structures, Systems, and Components Important to Safety.

11. Deviation A specific applicable requirement that will not be met. However, an equivalent function will be provided by different means. These must be documented by the DOE contractor and be approved by DOE.

12. DOE Site Boundary The area over which the DOE or its contractor(s) can exercise strict control without the aid or agreement of outside authorities.

13. Exemption A specific applicable requirement that will not be met but the incremental risk added to the operation is acceptable to DOE. These must be documented by the DOE contractor and be approved by DOE.

14. Externally-Initiated Accidents Events that are initiated by external disruptions or failures (e.g., earthquakes).

15. Facility Shutdown A condition in which the Facility shall be incapable of operation in accordance with its current mission unless substantial administrative actions and mechanical or physical activities are performed. For a Nuclear Reactor, the core shall be significantly subcritical. For other Facilities, the process or activity shall be physically or mechanically prevented from functioning.

16. Facility Site Boundary The area immediately surrounding DOE Facilities within the DOE Site Boundary, access to which can be limited by the DOE contractor, within which similar operations are performed, which complies with the facility emergency response plan, and subject to the authority of facility management.

17. Facility Workers All persons who are occupationally employed within the given Facility Site Boundary and persons temporarily within the Facility Site Boundary for purposes such as Facility visitors, service or delivery personnel, and maintenance or support personnel.

18. Fissionable Material Any material capable of sustaining a neutron-induced fission chain reaction.

19. Hazard A process, condition, or material which has the potential to adversely impact the health and safety of personnel, the public, or the environment.

20. Hazard Analysis A documented process: (1) to identify the quantity, form, and location of all Hazardous Materials in a Facility; (2) to describe and analyze potential energy sources and initiating events which could release and distribute any of the Hazardous Material within or outside of the Facility; and (3) to analyze the potential consequences from such releases to Facility Workers and Members of the Public.

21. Hazardous Materials Any solid, liquid, or gaseous material that is toxic, explosive, flammable, corrosive, or otherwise physically or biologically threatening to the health or safety of people or the environment.

22. Justification for Continued or Interim Operations (JCO/JIO) A DOE contractor prepared, DOE-approved, document that requests continuing operations when the facility mission or bases changes due to accidental or other initiating events.

23. Nuclear Facility Those activities, processes, or operations that involve Radioactive Materials and/or Fissionable Materials in such from, quantity, or concentration that a potential danger exists to cause illness, injury, or death to personnel within the Facility Site Boundary or to Members of the Public.

24. Nuclear Reactors Any combination of structures, systems, and components designed or used to sustain nuclear chain reactions in a controlled manner, including subcritical assemblies that could potentially become critical; critical and pulsed assemblies; and research, test, production, fusion, and power reactors.

25. Cognizant Secretarial Officer (CSO) The heads of DOE offices with responsibility for specific DOE Facilities. These include the Assistant Secretaries for Conservation and Renewable Energy, Environmental Restoration and Waste Management, Fossil Energy, and Defense Programs and the Directors of Energy Research, Civilian Radioactive Waste Management, and Nuclear Energy.

26. Protective Action Guides (PAG) The concentration of a Hazardous Material/chemical below which prolonged exposure to the stated chemical will not cause irreversible injury. Also, those personnel radiation exposure levels or ranges beyond which protective actions should be considered.

27. Radiological Terms

    a. Committed Dose Equivalent (CDE) The calculated Dose Equivalent projected to be received by a tissue or organ over a 50-year period after an intake of radionuclides into the body. It does not include contributions from external dose.

    b. Committed Effective Dose Equivalent (CEDE) The sum of the products of the weighing factors applicable to each of the body organs or tissues that are irradiated and the Committed Dose Equivalent to those organs or tissues. It does not include contributions from external dose.

    c. Deep Dose Equivalent (DDE) The Dose Equivalent in tissue at a depth of 1 cm deriving from external (penetrating) radiation.

d. Dose Equivalent (DE) The product of absorbed dose in tissue, a quality factor, and other modifying factors. The quality factors are those given in DOE 5480.11.

e. Effective Dose Equivalent (EDE) The sum of the products of the Dose Equivalent to the organ or tissue and the weighing factors applicable to each of the body organs or tissues that are irradiated. The weighing factors for an organ or tissue are those given in DOE 5480.11.

f. Total Effective Dose Equivalent (TEDE) The sum of the deep-dose equivalent (for external exposures) and the Committed Effective Dose Equivalent (for internal exposures).

28. Requirements Identification Document (RID) A document that identifies all requirements at a DOE Facility, including those that were not implemented when the facility was authorized or subsequently updated, that are important to the safe operation of the Facility.

29. Risk A quantitative or qualitative expression of possible loss that considers both the probability of occurrence of an event and the consequences of the event.

30. Safety Analysis Report (SAR) A Controlled Document which documents the adequacy of Safety Analysis for a Nuclear Facility to ensure that the Facility can be constructed, operated, maintained, shut down, and decommissioned safely and in compliance with applicable laws and regulations.

31. Safety Documentation Those documents: (1) that contain information associated with the design and construction of the Facility; (2) containing the Safety Basis, the Safety Analysis, the safety evaluations, and the requirements to ensure safe operation of the Facility; (3) containing the administrative, operating, and maintenance procedures for the Facility; and (4) that analyze and identify Unreviewed Safety Questions for the Facility.

32. Safety Envelope Those conditions for which the Facility (mission or stage or life cycle) has been designed, constructed, and tested; and which have been reviewed, evaluated, and determined to be appropriate to ensure safe operation of the Facility during any stage in its life cycle (Safety Basis and Safety Analysis). If any of these stated conditions are modified or changed (Unreviewed Safety Questions), the Safety Envelope must be reevaluated for that Facility.

33. Severe Natural Phenomenon Natural phenomena of a magnitude such that their occurrence is not expected within several orders of magnitude of the planned life of the Facility. Limiting parameters from these phenomena, depending on their importance to safety, are to be used in the design of the Facility.

34. Standard Review Plan (SRP) A document prepared to provide guidance to reviewers of Safety Analysis Report (SAR), including definition of subject scope, review procedures, and acceptance criteria.

35. Technical Safety Requirements (TSR) A controlled Document which documents the requirements for defining the safety boundaries, the operating conditions and surveillances, and the management and Administrative Controls necessary to ensure the safe operations of a Facility and to reduce the potential Risk to Members of the Public, and Facility Workers associated with the Facility from uncontrolled releases of Radioactive Material and other Hazardous Materials or from direct radiation exposure.

36. Toxicological Terms

    a. National Academy of Science (NAS) Terms - (Military Personnel Use)

    - Emergency Exposure Guidance Level (EEGL) is a ceiling guidance level for a single emergency exposure, usually lasting from 1 hour to 24 hours, a concentration judged by the Department of Defense to be acceptable for the performance of specific military tasks during rare emergency conditions.

    - Continuous Exposure Guidance Level (CEGL) is ceiling concentrations designed to avoid adverse health effects, either immediate or delayed, of more prolonged exposures and to avoid degradation in military crew performance.

    b. Emergency Response Planning Guidelines (ERPGs) Hazardous Material personnel exposure levels or ranges which, when exceeded by a short term or acute exposure, may cause irreversible or other serious health effects in humans. The ERPGs are approved by a committee of the American Industrial Hygiene Association (AIHA).

    - The ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

    - The ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

    - The ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

c. Immediately Dangerous to Life or Health (IDLH) - Respirator User (NIOSH) An atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.

d. Permissible Exposure Limits (PEL) - Occupational Safety Use (OSHA)

- Permissible Exposure Limit - Time - Weighted Average (PEL-TWA) is the time weight average airborne exposure in any 8-hour work shift of a 40-hour work week computed from the equation: $E = (C_aT_a+C_bT_b+ --)/8$, where C is the concentration during any period of T(hrs) where the concentration remains constant.

- Permissible Exposure Limit - Short-Term Exposure Limit (PEL-STEL) is the employee's 15-minute time weighted average exposure which shall not be exceeded at any time during a working day.

- Permissible Exposure Limit - Ceiling (PEL-C) is the employee's exposure which shall not be exceeded during any part of the work day. C may be assessed as a 15-minute time weighted average.

e. Threshold Limit Values (TLV) - Workplace Safety Use (ACGIH)

- Threshold Limit Value - Time-Weighted Average (TLV-TWA) is the time-weighed average concentration for a normal 8-hour work day and a 40-hour work week to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

- Threshold Limit Value-Short Term Exposure Limit (TLV-STEL) is the concentration to which workers can be exposed continuously for a short period of time without suffering from: 1) irritation, 2) chronic or irreversible tissue damage, or 3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue, or materially reduce work efficiency, and provided that the daily TLV-TWA is not exceeded.

- Threshold Limit Value - Ceiling (TLV-C) is the concentration that should not be exceeded during any part of a work period. It is an instantaneous concentration for fast acting substances.

f. Environmental Protection Agency (EPA) Terms - General Population

- Level of Concern (LOC) is the concentration of an extremely Hazardous Material in air above which there may be serious irreversible health effects or death as a result of a single exposure for a relatively short period of time.

- Reference Dose (RfD) is an estimate (with an uncertainty of order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable Risk of deleterious effects during a lifetime.

- Reference Concentration (RfC) is an estimate (with an uncertainty of an order of magnitude) of the airborne concentration that is likely to be without an appreciable Risk of deleterious effects during a lifetime exposure to the human population (including sensitive subgroups).