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Environmental Management

Safety ▪ Performance ▪ Cleanup ▪ Closure

Standard Review Plan (SRP)

Preliminary Safety Design Review Module





Corporate Critical Decision (CD) Review and Approval Framework Associated with Nuclear Facility Capital and Major Construction Projects

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OFFICE OF ENVIRONMENTAL MANAGEMENT

Standard Review Plan (SRP)

Preliminary Safety Design

Review Module

Critical Decision (CD) Applicability					
CD-0	**CD-1**	**CD-2**	**CD-3**	**CD-4**	**Post Operation**
		✓			

March 2010

FOREWORD

The Standard Review Plan (SRP)[1] provides a consistent, predictable corporate review framework to ensure that issues and risks that could challenge the success of Office of Environmental Management (EM) projects are identified early and addressed proactively. The internal EM project review process encompasses key milestones established by DOE O 413.3A, Change 1, *Program and Project Management for the Acquisition of Capital Assets*, DOE-STD-1189-2008, *Integration of Safety into the Design Process*, and EM's internal business management practices.

The SRP follows the Critical Decision (CD) process and consists of a series of Review Modules that address key functional areas of project management, engineering and design, safety, environment, security, and quality assurance, grouped by each specific CD phase.

This Review Module provides the starting point for a set of corporate Performance Expectations and Criteria. Review teams are expected to build on these and develop additional project-specific Lines of Inquiry, as needed. The criteria and the review process are intended to be used on an ongoing basis during the appropriate CD phase to ensure that issues are identified and resolved.

[1] *The entire EM SRP and individual Review Modules can be accessed on EM website at http://www.em.doe.gov/Pages/Safety.aspx , or on EM's internet Portal at https://edoe.doe.gov/portal/server.pt Please see under /Programmatic Folder/Project Management Subfolder.*

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ACRONYMS

ALARA	As Low As Reasonably Achievable
CD	Critical Decision
CSDR	Conceptual Safety Design Report
DBA	Design Basis Accident
DOE	Department of Energy
FPD	Federal Project Director
FRAM	Functions, Responsibilities, and Authorities Manual
HA	Hazard Analysis
HQ	Headquarters
PSD	Preliminary Safety Design
PSDR	Preliminary Safety Design Report
QA	Quality Assurance
RM	Review Module
SBAA	Safety Basis Approval Authority
SDIT	Safety Design Integration Team
SDS	Safety Design Strategy
SRP	Standard Review Plan
SSC	Safety Class and Safety Significant

I. INTRODUCTION

Integration of safety into the design development is a key element of the Department of Energy (DOE) design project design process and programs. In a memorandum to DOE elements, dated December 5, 2005, on integration of Safety-in-Design, the Deputy Secretary of Energy stated, "I expect safety to be fully integrated into design early in the project. Specifically, by the start of the preliminary design, I expect a hazard analysis of alternatives to be complete and the safety requirements for the design to be established. I expect both the project management and safety directives to lead projects on the right path so that safety issues are identified and addressed adequately early in the project design."

The need to integrate safety into the design from the earliest stages is identified in DOE O 413.3A, Change 1, *and Program and Project Management for the Acquisition of Capital Assets*. The order requires the development of a Conceptual Safety Design Report (CSDR) for CD-1, a Preliminary Safety Design Report at CD-2, a Preliminary Documented Safety Analysis Report for CD-3, and a Documented Safety Analysis Report for CD-4.

DOE-STD-1189-2008 provides the Department's expectations for incorporating safety into the design process for new or major modifications to DOE Hazard Category 1, 2, and 3 nuclear facilities. The Standard describes the Safety-in-Design philosophies to be used with the project management requirements of DOE O 413.3A. Standard 1189 address the development of a Safety Design Strategy (SDS). Review of the Safety Design through the various phases of the project is an essential element to the assurance that the project will meet the requirements and expectations of DOE Orders.

II. PURPOSE

The Preliminary Safety Design (PSD) Review Module (RM) is a tool that assists DOE federal project review teams in evaluating the adequacy of the Preliminary Safety Design work, processes and documentation prior to approval of CD-2. The PSD RM focuses on the safety design package key elements including safety guidance and requirements, hazards identification and control selection, Preliminary Safety Design Report (PSDR), risks to project safety decisions, safety analysis approach and plan, and safety design integration team interactions.

III. ROLES AND RESPONSIBILITIES

A successful PSD review depends on an experienced and qualified team. The team should be augmented with appropriate subject matter experts selected to complement the specific technical concerns of the project being reviewed. The specific types of expertise needed will be dependent on the type of facility being reviewed, as well as other factors such as complexity and hazards and risks.

It is strongly recommended that the team leader should either be a project or systems engineer experienced in the management of a multi-disciplined review team (e.g. fire protection,

criticality, radiological protection, nuclear) that matches to the extent practicable the contractors safety design integration team.

Management support is another necessary component to a successful PSD review. Field element managers, as well as the Federal Project Director (FPD), must recognize the importance of the PSD review and facilitate the resources necessary for its execution. This also requires appropriate interfaces with EM headquarters personnel who may direct or participate in the PSD review process.

The roles and responsibilities for all involved in the PSD review must be clear and consistent with various requirements of DOE O 413.3A and the DOE *Functions, Responsibilities, and Authorities Manual* (FRAM). The table below provides a compilation of preliminary safety design review roles and responsibilities.

Position	Responsibility
Field Element Manager	Provides support and resources to the Federal Project Director and Review Team Leader in carrying out the review.
	Facilitates the conduct of the review. Assigns office space, computer equipment, and support personnel to the team as necessary to accomplish the review in the scheduled time frame
Federal Project Director	Identifies the need for a PSD review and determines the scope of the review effort.
	In conjunction with the Contractor Project Manager, develops the briefing materials and schedule for the review activities.
	Coordinates the review team pre-visit activities and follows up review team requests for personnel to interview or material to review.
	Coordinates the necessary training and orientation activities to enable the review team members to access the facility and perform the review.
	Unless other personnel are assigned, acts as the site liaison with the review team. Tracks the status of requests for additional information.
	Coordinates the Federal site staff factual accuracy review of the draft report.
	Leads the development of the corrective action plan if required. Tracks the completion of corrective actions resulting from the review.
Review Team Leader	In coordination with the Federal Project Director and the Acquisition Executive, selects the areas to be reviewed.
	Based on the areas selected for review, project complexity and hazards involved, selects the members of the review team.
	Verifies the qualifications: technical knowledge; process knowledge; facility specific information; and independence of the Team Members.
	Leads the PSD review pre-visit.
	Leads the review team in completing the Review Criteria for the various areas to be reviewed.
	Coordinates the development of the data call and forwards to the Federal Project Director, a list of documents, briefings, interviews, and presentations needed to support the review.
	Forwards the final review plan to the Acquisition Executive for approval.
	Leads the on-site portion of the review.

Position	Responsibility
	Ensures the review team members complete and document their portions of the review and characterizes the findings.
	Coordinates incorporation of factual accuracy comments by Federal and Contractor personnel on the draft report.
	Forwards the final review report to the Acquisition Executive for consideration in making the decision to authorize approval of the Critical Decision (CD).
	Participates, as necessary in the closure verification of the findings from the review report.
Review Team Member	Refines and finalizes the criteria for assigned area of the review.
	Develops and provides the data call of documents, briefings, interviews, and presentations needed for his or her area of the review.
	Completes training and orientation activities necessary for the review. Conducts any necessary pre visit document review.
	Participates in the on-site review activities, conducts interviews, document reviews, walk downs, and observations as necessary.
	Based on the criteria and review approaches in the Review Plan, assesses whether his or her assigned criteria have been met.
	Documents the results of the review for his or her areas. Prepares input to the review report.
	Makes recommendations to the Review Team Leader for characterization of findings in his or her area of review.
	Resolves applicable Federal and Contractor factual accuracy comments on the draft review report.
	Prepares the final review report for his or her area of review.

IV. REVIEW SCOPE AND CRITERIA

This PSD Review Module provides a set of review criteria that are organized based on the key technical and safety areas and disciplines identified in the DOE Orders and guidance for the preliminary safety design and the associated documents (e.g. hazards analysis, updated safety design strategy and preliminary safety design report). These review areas are summarized below and include safety guidance and requirements, hazards identification and control selection, Preliminary Safety Design Report (PSDR), risks to project safety decisions, safety analysis approach and plan, and safety design integration team interactions.

It is important to recognize that because the design is still evolving at this point in the process, adequate Safety-in-Design for the preliminary design phase is based primarily on identifying viable engineering resolutions to nuclear safety design requirements and specifying an adequate set of more detailed safety design requirements that are based on safety analysis. During this phase a more complete assessment of hazard controls, based on hazards analyses at the process level is developed, including those intended for worker protection.

The PSDR must be approved by the Federal Project Director and Safety Basis Approval Authority (SBAA). The basis of the PDSR approval is documented in a Preliminary Safety

Validation Report. The DOE Lead Reviewer shall ensure that a formal correspondence package addresses whether the following elements are met:

(1) The PSDR is prepared by the design contractor's Safety Design Integration Team (i.e., reflects input from appropriate project personnel);
(2) PSDR format and content are consistent with DOE-STD-1189-2008, Appendix I; and
(3) The PSDR is submitted to DOE prior to or concurrent with official contractor submission of a facility's preliminary design documents.

As verification that the PSDR is compliant with DOE-STD-1189-2008 (Item #2 above), Appendix A criteria are provided and must be completed by the DOE Lead Reviewer and attached to the official correspondence package approving the PSDR.

If any of the above elements are not satisfactorily addressed, the DOE Lead Reviewer should prepare correspondence that either rejects the PSDR or provides explicit actions expected on the part of the design contractor (i.e., actions, completion dates). The PSDR should be rejected if it has major deficiencies with respect to DOE-STD-1189-2008 requirements. In cases where the PSDR has incomplete information because of the lack of available design information, the Lead Reviewer may consider a condition of approval with expectations tied to future design phases.

For each review area, Appendix A of this RM provides overall performance objectives and then a subset of review criteria that satisfy each performance objective. These performance objectives and review criteria will provide consistent guidance to project-specific SDS review teams to develop their Lines of Inquiry.

Safety Guidance and Requirements

This area of the review is intended to ensure that the SDS is updated as appropriate and presents the overarching philosophies and goals to be used by the project to address the identified hazards. This review area also addresses the adequacy of the criteria or approach to safety functional classification and the safety design criteria to be applied to the project.

Hazard Identification & Control Selection

This area is focused on ensuring that the documentation provides a logical discussion of the major hazards involved in the project and the possible consequences those hazards may pose. This review area will also ensure that the hazards identification is based on the initial or assumed inventories and the preliminary design documentation. For the preliminary design phase the hazards analysis process should have evolved from a facility-level analysis to a system level hazard analysis based on the available design detail.

The control selection process should have evolved to include developing functional requirements and performance criteria for safety SSCs including those for protection of the facility worker.

Preliminary Safety Design Report

The review area addresses the adequacy of the PSDR as provided by the contractor to DOE for support of CD-2 approval. Specifically the review area provides LOIs to evaluate the submittal against the guidance for PSDRs provided in DOE-STD-1189-2008.

Risks to Project Safety Decisions

This review area is designed to ensure that the any key risks associated with the identified safety decisions are identified and addressed. Specifically the update of the Safety-in-design Risk and Opportunity Assessment needs to be updated to reflect changes from the conceptual to the preliminary design phase.

Safety Design Integration Team – Interfaces and Integration

This review area is focused on the functional adequacy of the SDIT within the project. The review area will also address the key and primary interfaces not only for the design function but also for major project areas and disciplines.

V. REVIEW PLANS AND DOCUMENTATION

The results of a PSD review will be used by the DOE Federal Project Director and ultimately the Acquisition Executive to help determine whether to approve CD-2. It is important to clearly document the methods, assumptions and results of the PSD review. The following activities should be conducted as part of the Review Plan development, documentation, and closure of the review:

- Subsequent to the selection, formation and chartering of the review team, receipt and review of the prerequisite documents, assignment of responsibilities for the development of specific lines of inquiry should be made.
- The review team members should develop specific lines of inquiry utilizing the topics and areas listed in the respective appendices of this module.
- The individual lines of inquiry should be compiled and submitted to the manager authorizing the review for concurrence prior to starting the review.
- The project-specific review plan should be compiled with a consistent and uniform numbering scheme that provided for a unique identifier for each line of inquiry, arranged by subject such that the results of each line of inquiry can be documented and tracked to closure.
- The lines of inquiry should be satisfied via document review and personnel interviews and any combination of these methods. The method used the basis for closure, comment, finding, and the result of the inquiry should all be documented and tracked.

VI. REFERENCE MATERIAL

- DOE O 413.3A, Change 1, *Program and Project Management for the Acquisition of Capital Assets*
- DOE O 420.1B, *Facility Safety*
- DOE M 413.3-1, *Project Management for the Acquisition of Capital Assets*
- DOE-STD-1189-2008, *Integration of Safety into the Design Process*

APPENDIX A - PERFORMANCE OBJECTIVES AND CRITERIA

Legend of Safety and Engineering Review Topics

Review Topical Area	Identifier
Safety Guidance & Requirements	SG
Hazards Identification & Control Selection	HI
Preliminary Safety Design Report	PR
Risks to Project Safety Decisions	SR
Safety Design Integration Team – Interface and Integration	II

ID #	Performance Objectives and Criteria[2]	Met?
Safety Guidance & Requirements		
SG-1	Does the Preliminary Safety Design documentation demonstrate how the design will satisfy the nuclear safety design criteria of DOE O 420.1B?	
	Does the facility safety design include multiple layers of protection to prevent or mitigate the unintended release of radioactive materials to the environment (e.g. provide defense in depth)? **(SG-1.1)**	
	Do the multiple layers include multiple physical barriers to the extent practicable? **(SG-1.2)**	
	If the multiple layers are not physical barriers (e.g. they include administrative controls) are the basis for the use of administrative controls adequately documented? **(SG-1.3)**	
SG-2	Does the defense in depth strategy provided in the PSD documentation address all of the require elements in DOE 20.1B?	
	Does defense in depth address: • Choosing the appropriate site • Minimizing the quantity of material at risk • Applying conservative design margins and QA • Using successive physical barriers • Using multiple means to ensure critical safety functions needed to control processes, maintain processes in safe status and confine and mitigate the potential for accidents with radiological releases • Using equipment and administrative controls that restrict deviation from normal operations, monitor facility conditions during and after and event, and provide for response to accidents to achieve a safe condition • Providing means to monitor accident releases as required for emergency response • Establishing emergency plans for minimizing the effects of an accident? **(SG-2.1)**	

[2] *The site should provide the technical bases and assumptions that support the answers provided to each Line of Inquiry. If possible, the review teams should independently verify the technical bases and assumptions.*

ID #	Performance Objectives and Criteria[2]	Met?
	Does the preliminary safety design documentation demonstrate that the facility will be sighted, designed and constructed in a manner that ensures adequate protection of the health and safety of the public, workers and the environment? **(SG-2.2)**	
	Does the preliminary safety design documentation demonstrate that confinement design considerations included: • An adequate number, arrangement and characteristics of confinement barriers • The type, quantity, form, and conditions for dispersing the radioactive material in the confinement system design • Use of engineering evaluations, tradeoffs, and experience to develop practical designs that achieve confinement system objectives • The adequacy of confinement systems to perform required functions? **(SG-2.3)**	
	Does the preliminary safety design documentation demonstrate that the facility is being designed to: • Facilitate safe deactivation, decommissioning and decontamination at the end of facility life • Facilitate inspections, testing, maintenance, repair and replacement of safety SSCs as a part of a reliability, availability and maintainability program with the objective that the facility is maintained in a safe state • Keep occupational radiation exposures within statutory limits and as low as reasonably achievable (ALARA)? **(SG-2.4)**	
	Does the preliminary safety design documentation demonstrate that facility process systems are being/have been designed to minimize waste production and mixing of radioactive and non-radioactive wastes? **(SG-2.5)**	
	Does the preliminary safety design documentation demonstrate that Safety SSCs and safety software are being or have been designed commensurate with the importance of the safety functions performed? **(SG-2.6)**	
	Does the preliminary safety design documentation demonstrate that safety class electrical systems are being/have been designed to preclude single point failure? **(SG-2.7)**	
SG-3	If requirements other than those of DOE O 420.1B are proposed does the Preliminary Safety Design documentation demonstrate how the design will satisfy these criteria and provide a basis for selection of these criteria?	
Hazard Identification & Control Selection		
HI-1	Did the hazard analysis activities in the preliminary phase address the key elements of DOE-STD-1189-2008 section 4.3?	
	Was the facility hazard categorization updated (if needed)? **(HI-1.1)**	
	Was the analysis of the Design Basis Accident (DBAs) identified in the conceptual design updated to confirm the selection of facility-level hazard controls and their functional classifications? **(HI-1.2)**	
	Was a system-level hazard analysis performed and used to select and classify hazard controls for the facility worker? **(HI-1.3)**	

ID #	Performance Objectives and Criteria[2]	Met?
	Does the updated hazard analysis include consideration of beyond-DBA events? **(HI-1.4)**	
HI-2	Were the appropriate prerequisites included in developing or updating the conceptual design hazard analysis?	
	Did the prerequisites include the following: • Facility general layout drawings • Process and Instrumentation Diagrams • Updated process flow sheets • Electrical one-line diagrams and • Updated listing and locations of material at risk? **(HI-2.1)**	
HI-3	Is the Hazard Analysis (HA) adequate and does it meet the minimum requirements identified in the DOE guidance and requirements?	
	Does the HA address the spectrum of accidents that may impact design and which may be initiated by facility operation, natural phenomena, and external man-induced events? **(HI-3.1)**	
	Does the HA evaluate potential accident consequences to the public and workers? **(HI-3.2)**	
	Does the HA identify and assess associated preventative and imitative features including classification (e.g. safety class, safety significant, etc.)? **(HI-3.3)**	
HI-4	Do the results of the HA provide an appropriate comprehensive evaluation of the complete facility hazardous event scenarios and accident spectra necessary to define the design?	
HI-5	Was a graded approach applied to the HA process based on the magnitude and complexity of the hazards of the facility?	
HI-6	Are design details for safety SSCs developed that incorporate design requirements derived from the HA, the updated DBA analysis and the governing requirements?	
HI-7	Does the HA indicate whether the facility contains significant chemical hazards that necessitate DBA analysis for consideration of (SSCs)?	
Preliminary Safety Design Report		
PR-1	Does the PSDR meet the format and guidance criteria in DOE-STD-1189-2008, Appendix I?	
	Does the PSDR include an "Executive Summary" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix I? **(PR-1.1)**	
	Does the PSDR include a chapter on "Site Characteristics" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix I? **(PR-1.2)**	
	Does the PSDR include a chapter on "Facility Description – Preliminary Design" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix I **(PR-1.3)**	
	Does the PSDR include a chapter on "Hazard Analysis, Accident Analysis and Control Selection" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix I **(PR-1.4)**	

ID #	Performance Objectives and Criteria[2]	Met?
	Does the PSDR include a chapter on "Safety Structures, Systems and Components for Preliminary Design" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix I **(PR-1.5)**	
	Does the PSDR include a chapter on "Preliminary Derivation of Technical Safety Requirements" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix I **(PR-1.6)**	
	Does the PSDR include a chapter on "Design for the Prevention of Inadvertent Criticality" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix I **(PR-1.7)**	
Risks to Project Safety Decisions		
PR-1	Has the Safety-in-Design Risk and Opportunity Assessment developed in the conceptual design phase been updated?	
	Does the update reflect the results of: • Technical studies completed • Design modifications • Other developmental work that impact the risk assessment? **(PR-1.1)**	
	Does the Safety-in-Design Opportunity Assessment interface with the project risk management plan consistent with the guidance and expectations identified in DOE-STD-1189-2008, Appendix F? **(PR-1.2)**	
Safety Design Integration Team – Interfaces and Integration		
II-1	Does the Safety Design Integration include the interface organizations and activities identified in Table 7-1 of DOE-STD-1189-2008 as appropriate?	
II-2	Do the interfaces include (as appropriate): • QA • Fire Protection • Criticality Safety • Radiological Protection • Human Factors • Security • Environmental Protection • Hazardous Materials • Radiological and Hazardous Waste Management • Emergency Preparedness • External Reviews • System Engineer Program • Procedures, Training and Qualification?	
II-3	Do these interfaces address the appropriate resource requirements and guidance as identified in Table 7-1?	