

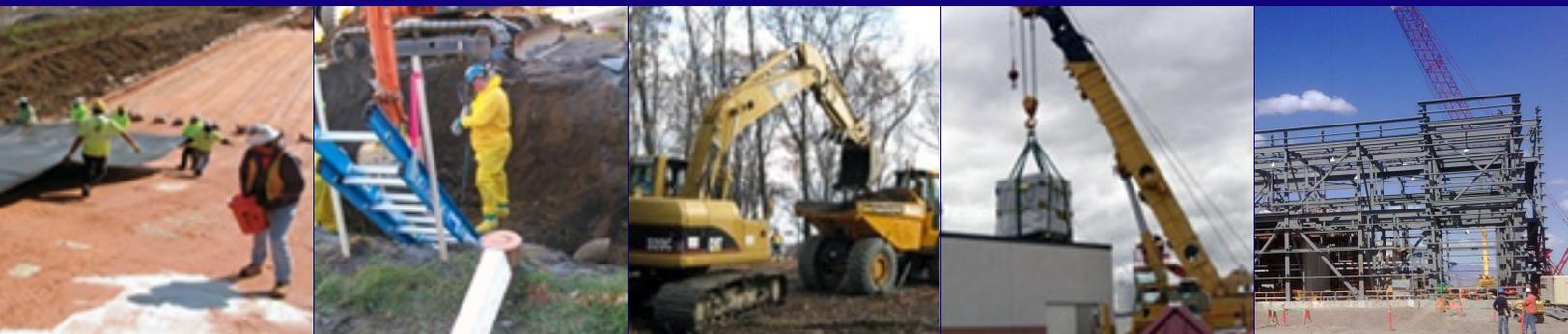


DOE - EM - SRP - 2010
2nd Edition

Environmental Management
Safety ▪ Performance ▪ Cleanup ▪ Closure

STANDARD REVIEW PLAN (SRP)

CONCEPTUAL SAFETY DESIGN REVIEW MODULE



**CORPORATE CRITICAL DECISION (CD) REVIEW AND
APPROVAL FRAMEWORK ASSOCIATED WITH NUCLEAR FACILITY CAPITAL AND
MAJOR CONSTRUCTION PROJECTS**

MARCH 2010

OFFICE OF ENVIRONMENTAL MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON D. C. 20585

OFFICE OF ENVIRONMENTAL MANAGEMENT

Standard Review Plan (SRP)

Conceptual 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.*

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	PURPOSE.....	1
III.	ROLES AND RESPONSIBILITIES	1
IV.	REVIEW SCOPE AND CRITERIA	3
V.	REVIEW PLANS AND DOCUMENTATION	5
VI.	REFERENCE MATERIAL	5
	APPENDIX A - PERFORMANCE OBJECTIVES AND CRITERIA	A-1

ACRONYMS

CD	Critical Decision
CDR	Critical Decision Review
CSD	Conceptual Safety Design
CSDR	Conceptual Safety Design Report
CSVR	Conceptual Safety Validation Report
DBA	Design Basis Accident
DOE	Department of Energy
FPD	Federal Project Director
FRAM	Functions, Responsibilities, and Authorities
IPT	Integrated Project Team
LOIs	Lines of Inquiry
NPH	Natural Phenomena Hazard
PHA	Preliminary Hazard Analysis
RM	Review Module
SBAA	Safety Basis Approval Authority
SDIT	Safety Design Integration Team
SDS	Safety Design Strategy
SRP	Standard Review Plan
SSC	Structures, Systems, and Components

I. INTRODUCTION

Integration of safety into the design development is a key element of the Department of Energy (DOE) 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 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. DOE-STD-1189-2008 addresses 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 Conceptual Safety Design (CSD) Review Module (RM) is a tool that assists DOE federal project review teams in evaluating the adequacy of the Conceptual Safety Design work, processes and documentation prior to approval of CD-1. The CSD RM focuses on safety design package key elements including the safety design strategy, safety guidance and requirements, hazards identification and control selection, Conceptual Safety Design Report (CSDR), risks to project safety decisions, and safety design integration team interactions.

III. ROLES AND RESPONSIBILITIES

A successful CSD 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 or 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 CSD review. Field element managers, as well as the Federal Project Director, must recognize the importance of the CSD 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 CSD review process.

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

Position	Responsibility
	Forwards the final review report to the Acquisition Executive for consideration in making the decision to authorize approval of the 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 CSD RM provides a set of review criteria that are organized based on the key technical, safety areas, and disciplines identified in the DOE Orders and guidance for the conceptual safety design and the associated documents (e.g. hazards analysis, safety design strategy and conceptual safety design report). These review areas are summarized below and include SDS, safety guidance and requirements, hazards identification and control selection, CSDR, risks to project safety decisions, and safety design integration team interactions.

It is important to recognize that the overall goal for Safety-in-Design at the conceptual design phase is to evaluate alternative design concepts, to prepare a SDS, and to provide a conservative safety design basis for a preferred concept to proceed into preliminary design. The intent is to perform sufficient analysis to make sound safety decisions during conceptual design and to document any risks and opportunities associated with selections and the associated project cost range and schedule impacts. The conceptual design phase presents a key opportunity for the safety analysis to influence the design.

The CSDR must be approved by the Federal Project Director and Safety Basis Approval Authority. The basis of the CSDR approval is documented in a Conceptual Safety Validation Report (CSV). The DOE Lead Reviewer shall ensure that a formal correspondence package addresses whether the following elements are met:

- The CSDR is prepared by the design contractor’s Safety Design Integration Team (i.e., reflects input from appropriate project personnel);
- CSDR format and content are consistent with DOE-STD-1189-2008, Appendix H; and

- The CSDR is submitted to DOE prior to or concurrent with official contractor submission of a facility's conceptual design documents.

As verification that the CSDR 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 CSDR.

If any of the above elements are not satisfactorily addressed, the DOE Lead Reviewer should prepare correspondence that either rejects the CSDR or provides explicit actions expected on the part of the design contractor (i.e., actions, completion dates). The CSDR should be rejected if it has major deficiencies with respect to DOE-STD-1189-2008 requirements.

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 Design Strategy

This area of the review is intended to ensure that the SDS is developed and is appropriate for the project. The SDS adequately 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. Hazards analysis needs to be performed and documented for the appropriate alternatives considered. This review area will also ensure that the hazards identification is based on the initial or assumed inventories hazards for the selected alternative.

Conceptual Safety Design Report

The review area addresses the adequacy of the CSDR as provided by the contractor to DOE for support of CD-1 approval. Specifically the review area provides Lines of Inquiry (LOIs) to evaluate the submittal against the guidance for CSDRs 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 this review area focuses on ensuring that the development of the Safety-in-design Risk and Opportunity Assessment consistent with the guidance and requirements of DOE –STD-1189-2008.

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/primary interfaces not only for the design function but also for major project areas/disciplines.

V. REVIEW PLANS AND DOCUMENTATION

The results of a CSD review will be used by the FPD, SBAA, and ultimately the Acquisition Executive to help determine whether to approve CD-1. It is important to clearly document the methods, assumptions and results of the CSD review.

The following activities should be conducted as part of the Review Plan development and documentation/closure of the review:

- Subsequent to the selection, formation and chartering of the review team and 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 Manual DOE M 413.3-1, *Project Management for the Acquisition of Capital Asset*
- DOE O 420.1B, *Facility Safety*
- DOE-STD-1189-2008, *Integration of Safety into the Design Process*

APPENDIX A: PERFORMANCE OBJECTIVES AND CRITERIA

Legend of Conceptual Safety Design Review Topics

Review Topical Area	Identifier
Safety Design Strategy	SD
Hazards Identification & Control Selection	HI
Conceptual Safety Design Report	CR
Risks to Project Safety Decisions	SR
Safety Design Integration Team – Interface and Integration	II

ID #	Performance Objectives and Criteria ²	Met?
Safety Design Strategy & General Requirements		
SD-1	Does the SDS include the key elements required by DOE-STD-1189-2008?	
	Does the SDS describe or define the Safety-in-Design approach and philosophies? (SD-1.1)	
	Does the SDS define the criteria or approach to safety functional classification, including evaluation guidelines for both radiological and toxicological hazards and for public and worker protection? (SD-1.2)	
	Does the SDS identify the safety criteria to be applied to the project (commitment to DOE G 420.1-1; DOE O 420.1B, etc)? (SD-1.3)	
	Does the SDS provide a logical discussion of the major hazards involved in the project and the possible consequences those hazards may pose? (SD-1.4)	
	Is the hazard identification based on the initial or assumed hazard inventories? (SD-1.5)	
	Does the SDS discuss key safety decisions that potentially result in significant cost or have resulted in costly rework in past projects? (SD-1.6)	
	Are the following topics explicitly addressed in the SDS and the strategy justified consistent with the hazard categorization and any associated consequence estimates <ul style="list-style-type: none"> • Seismic and other natural phenomena • Confinement Strategy • Fire Mitigation Strategy • Anticipated safety functions? (SD-1.7) 	
SD-2	Does the SDS meet the format and guidance criteria in DOE-STD-1189-2008, Appendix E?	
	Does the SDS include a “Purpose” section that addresses the format and content requirements of DOE-STD-1189-2008 Appendix E? (SD-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 SDS include a “Description of Project/Modification” section that addresses the format and content requirements of DOE-STD-1189-2008 Appendix E? (SD-2.2)	
	Does the SDS include a “Safety Strategy” section that addresses the format and content requirements of DOE-STD-1189-2008 Appendix E? (SD-2.3)	
	Does the SDS include a “Risks to Project Safety Decisions” section that addresses the format and content requirements of DOE-STD-1189-2008 Appendix E? (SD-2.4)	
	Does the SDS include a “Safety Analysis Approach and Plan” section that addresses the format and content requirements of DOE-STD-1189-2008 Appendix E? (SD-2.5)	
	Does the SDS include a “SDIT- Interfaces and Integration” section that addresses the format and content requirements of DOE-STD-1189-2008 Appendix E? (SD-2.6)	
SD-3	Did the hazard analysis activities in the conceptual design phase address the key elements of DOE-STD-1189-2008 section 3.2?	
	When design requirements are established, are alternatives evaluated to establish a process approach that includes facility and equipment arrangements? (SD-3.1)	
	Have DOE expectations for Safety-in-Design and the Safety Design Guiding Principles and key concepts been applied to ensure that the design requirements and the selection of the preferred processing and facility arrangement alternatives were performed in a way that will result in a safe design? (SD-3.2)	
	Has a safety analyst been involved as part of the evaluation for each of the various alternatives? (SD-3.3)	
	Have the Integrated Project Team (IPT) and the SDIT ensured that the relative hazards, as well as the costs and uncertainties associated with the hazard controls that may be required to address these hazards are considered for each alternative? (SD-3.4)	
	Have the safety design requirements and considerations in DOE O 420.1B been addressed in the design? (SD-3.5)	
	<p>Has the safety work completed for the conceptual design phase accomplished the following:</p> <ul style="list-style-type: none"> • Document and establish the preliminary inventory of hazardous materials • Establish and document the preliminary hazard categorization of the facility • Identify and analyze primary facility hazards and facility-level design basis accidents • Provide an initial determination, based on the PHA, of safety class and safety significant Structures, Systems, and Components (SSCs)? (SD-3.6) 	
	Has a Safety-in-Design and Opportunity Assessment been used to evaluate the overall safety design basis risks and opportunities associated with the project? (SD-3.7)	

ID #	Performance Objectives and Criteria ²	Met?
	<p>Have the following major activities taken place during the conceptual design phase:</p> <ul style="list-style-type: none"> • The requirements analysis from the pre-conceptual phase has been further developed to include safety functions and SSC requirements and is documented in the CDR • Alternative design concepts have been analyzed and a preferred alternative has been selected • A SDS has been developed that meets the requirements listed above • A preliminary hazards analysis (PHA) has been performed to provide the basis for facility preliminary hazard categorization • A preliminary Fire Hazards Analysis has been performed that identifies and assess fire risk and defines levels of Safety-in-Design • A preliminary security Vulnerability assessment is completed and factored into the PHA • A facility-level DBA analysis has been performed to identify the major facility safety functions needed • The SSCs and the safety classifications are proposed for the major safety functions • The initial Safety-in-Design Risk and Opportunities Assessment has been developed • The CDR has been developed to document the final conceptual design • The CDSR has been developed to document the bases for the safety design aspects of the facility • Required technical studies necessary to resolve risks and opportunities have been identified • The initial baseline range estimates have been identified? (SD-3.8) 	
Hazard Identification & Control Selection		
HI-1	Did the hazard analysis activities in the conceptual design phase address the key elements of DOE-STD-1189-2008 section 4.2?	
	When design requirements are established, are alternatives evaluated to establish a process approach that includes facility and equipment arrangements? (HI-1.1)	
	Do hazards analyses support the preliminary identification of the required safety functions as well as the preliminary set of SSCs? (HI-1.2)	
	Has the hazards analysis been used to support preliminary identification of defense-in-depth or important to safety SSCs to the design staff as appropriate? (HI-1.3)	
HI-2	Are controls strategies for DBAs clearly identified in the hazard analysis?	
	Does the DBA control strategy include required safety functions and classifications? (HI-2.1)	
	Does the DBA control strategy include the SSCs required to perform the identified safety functions? (HI-2.2)	

ID #	Performance Objectives and Criteria ²	Met?
	Does the DBA control strategy include natural phenomena hazard (NPH) performance categories (non seismic NPH) and seismic design bases for major SSCs? (HI-2.3)	
	Was the hazards analysis process used to arrive at the identified controls based on sound safety principles? (HI-2.4)	
	Were the hazards analysis process and the criteria for selection of safety SSCs appropriately conservative? (HI-2.5)	
HI-3	<p>Were the necessary inputs for the completion of the PHA provided and used in the PHA process including:</p> <ul style="list-style-type: none"> • Facility site or location selection • General arrangement drawings • MAR estimates or assumptions and material flow balances • Sizing of major process system containers, tanks, piping and similar items • Process block flow diagrams or equivalent documentation of the required major process flow steps and their sequence • Preliminary one-line diagrams for ventilation, electrical power and distribution, special mechanical handling, instrumentation and control system architecture • Summary process design description and sequence of major operations; and • Confinement strategy? 	
HI-4	<p>Did the hazards analysis performed in the conceptual design phase identify the high cost safety functions and design requirements for the SSCs that will be included in the project , including the following as appropriate:</p> <ul style="list-style-type: none"> • Building structure • Building and process confinement • Power systems, including those associated with single failure criteria for safety class SSCs • Fire protection provisions; and • Special mechanical equipment (e.g., glove boxes)? 	
HI-5	Did the PHA establish an appropriate suite of DBAs to define functional and performance requirements for the facility design?	
	<p>Did the PHA DBAs include internally initiated events such as:</p> <ul style="list-style-type: none"> • Fire • Explosion • Loss of containment/confinement • Process upsets • Inadvertent nuclear criticality? (HI-5.1) 	
	Did the PHA DBAs include the appropriate externally initiated events? (HI-5.2)	
	Did the PHA DBAs consider the appropriate NPH initiated events? (HI-5.3)	
HI-6	Are the hazardous release event evaluations based on facility-level events?	
HI-7	For those events with consequences that do not lead to selection of safety class or safety significant controls, does the analysis identify the controls that appropriate for collocated worker and public defense-in-depth?	

ID #	Performance Objectives and Criteria ²	Met?
Conceptual Safety Design Report		
	Does the CSDR meet the format and guidance criteria in DOE-STD-1189-2008, Appendix H?	
	Does the CSDR include an "Introduction" section that addresses the format and content requirements of DOE-STD-1189-2008 Appendix H including: <ul style="list-style-type: none"> • Facility Mission Overview, and • Site location? (CR-1.1) 	
	Does the CSDR include a chapter on "Conceptual Design Description" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix H including: <ul style="list-style-type: none"> • Facility Structure and Layout • Process Description? (CR-1.2) 	
	Does the CSDR include a chapter on "Preliminary Hazard Categorization" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix H including: <ul style="list-style-type: none"> • Hazardous Material Inventories • Comparison of Inventories to Threshold Quantities? (CR-1.3) 	
	Does the CSDR include a chapter on "Design Basis Accidents" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix H: <ul style="list-style-type: none"> • Facility-Level DBAs • Unmitigated DBA Analyses • Preliminary Selection and Classification of Safety SSCs? (CR-1.4) 	
	Does the CSDR include a chapter on "Security Hazards and Design Implications" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix H? (CR-1.5)	
	Does the CSDR include a chapter on "Nuclear Safety Design Criteria" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix H including: <ul style="list-style-type: none"> • Approach for Compliance with Design Criteria • Exceptions to Design Criteria? (CR-1.6) 	
	Does the CSDR include a chapter on "Other Considerations" that addresses the format and content requirements of DOE-STD-1189-2008 Appendix H including: <ul style="list-style-type: none"> • Planned Studies and Analyses • Safety-in-Design Risks and Opportunities • Lessons Learned from Previous Experience Involving Major Systems? (CR-1.7) 	
Risks to Project Safety Decisions		
PR-1	Has the Safety-in-Design Risk and Opportunity Assessment been developed?	
	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-1.1)	

ID #	Performance Objectives and Criteria ²	Met?
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): <ul style="list-style-type: none"> • 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?	