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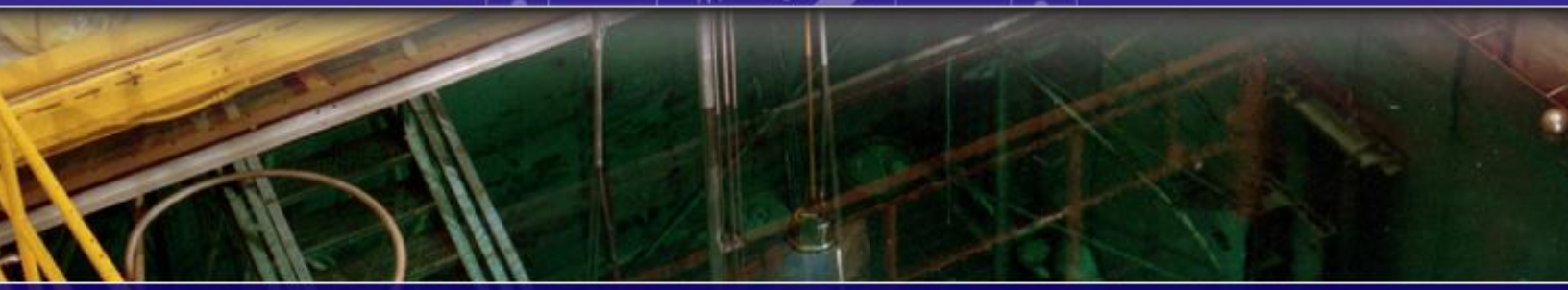


Strengthening Line Management Oversight and
Federal Monitoring of Nuclear Facilities

Standard Review Plan

Volume 2 -- Nuclear Safety Basis Program Review During Design

February 2015

Standard Review Plan

Volume 2

Nuclear Safety Basis Program Review during Design

Facility Life Cycle Applicability					
CD-1	CD-2	CD-3	CD-4	Operations and Transitions	Decommissioning & Environmental Restoration
✓	✓	✓	✓		

February 2015

Table of Contents

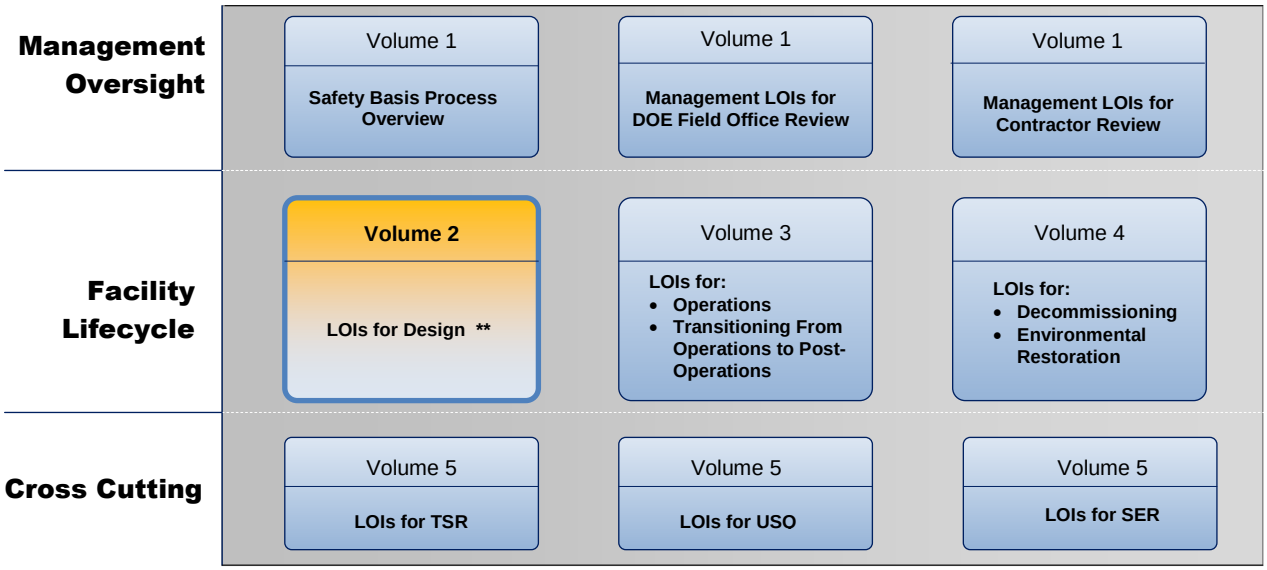
Acronyms

CD	Critical Decision
COA	Condition of Approval
COR	Code of Record
CSDR	Conceptual Safety Design Report
CSVR	Conceptual Safety Validation Report
DBA	Design Basis Accident
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EG	Evaluation Guideline
FHA	Fire Hazard Analysis
HA	Hazard Analysis
HC	Hazard Categorization
LOI	Line of Inquiry
NPH	Natural Phenomena Hazard
PDSA	Preliminary Documented Safety Analysis
PHA	Preliminary Hazards Analysis
PSDR	Preliminary Safety Design Report
PSVR	Preliminary Safety Validation Report
SBAA	Safety Basis Approval Authority
SSC	Structures, Systems and Components
SDS	Safety Design Strategy
SER	Safety Evaluation Report
SRP	Standard Review Plan
TSR	Technical Safety Requirements
USQ	Unreviewed Safety Question

Introduction

Subpart B of the DOE Nuclear Safety Management regulation (10 CFR Part 830) establishes safety basis requirements for DOE nuclear facilities. This SRP, *Safety Basis Program Review*, contains five volumes to help strengthen the technical rigor of line management oversight and federal monitoring of DOE nuclear facilities during the entire facility life cycle[1]. The SRP provides a set of LOIs for the review of safety basis programs and documents of nuclear facilities at various stages of the facility life cycle. These LOIs were developed based on the review of the DOE regulations, directives and technical standards, as well as from best management practices. These LOIs provide consistency in the safety basis review process and using the graded approach, they can be tailored to specific circumstances. Additional and specific LOIs can also be developed beyond these LOIs.

The contents of the five SRP volumes are described below. Volume 2 contains LOIs for the review of the safety basis activities during facility design.



** The review of the Safety Design Strategy (SDS) and the Code of Record (COR) is an important part of the safety-in-design review process. The LOIs for SDS and COR are contained in two stand-alone SRPs.

[1] Facility life cycle includes design, construction, startup, operations, transitions, decommissioning and environmental restoration.

Overview of Safety Basis Process during Nuclear Project Design

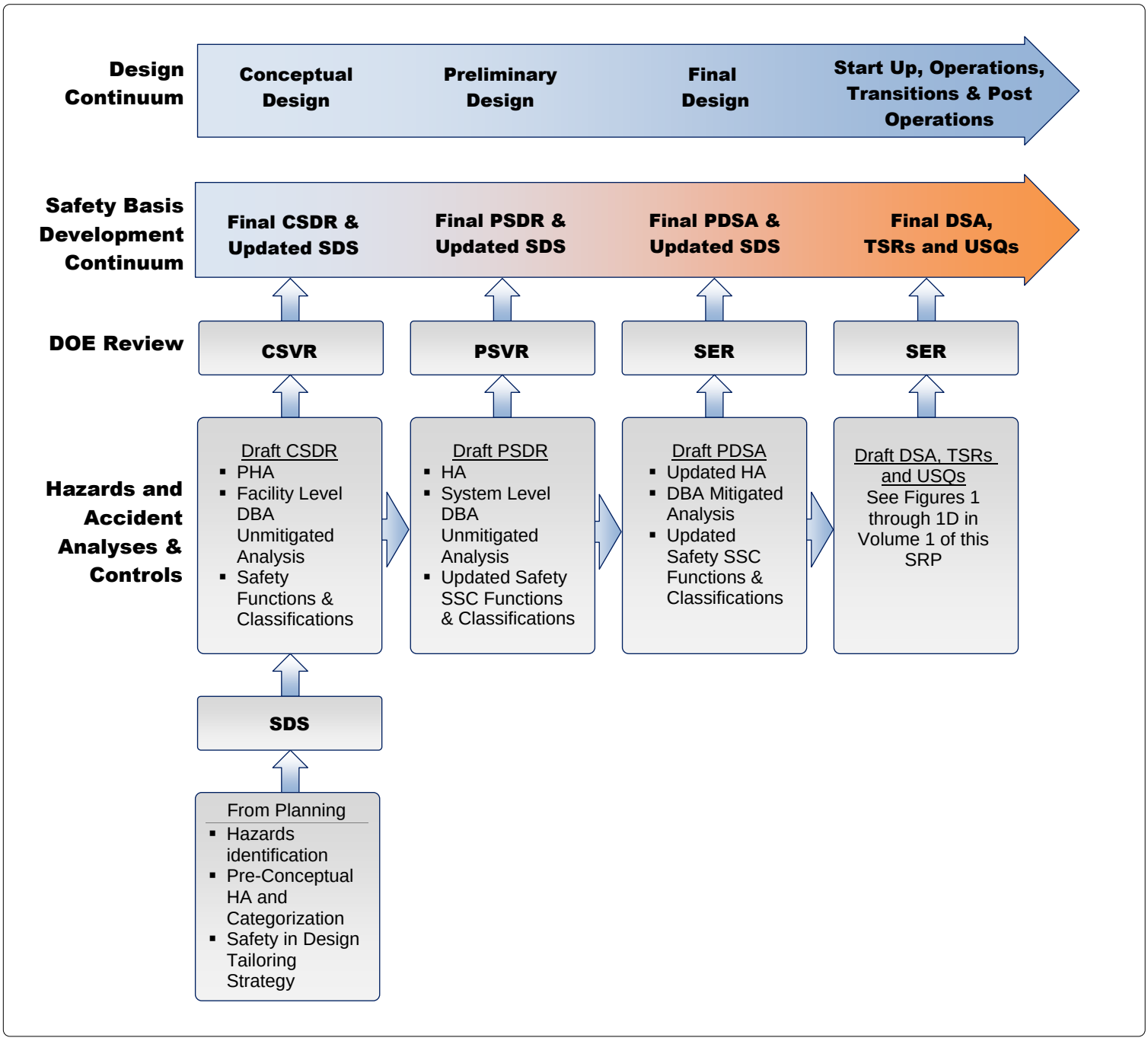
Safety basis development is a continuous process beginning early in the nuclear project design. As the conceptual design evolves into a final design for construction, start up and operations, so does the safety basis development. Concurrent hazards and accident analyses identify key safety features required for design and identify the key parameters necessary for safe operations. The iterative design process, from defining mission need and a conceptual design to final design for construction, is dictated by DOE Directives, specifically DOE O 413.3B. This Order contains safety basis documentation requirements for each CD approval phase and it requires the implementation of DOE-STD-1189 for the integration of safety into the design process. DOE-STD-1189 describes in detail the safety basis development process as illustrated by the figure on the following page. Some of the key concepts in the standard are listed below.

- The development of a SDS that provides a roadmap for strategizing how important safety issues will be addressed in the design and in the tailoring in the development of key safety documentation. The SDS should be initiated based on a statement of DOE expectations for Safety-in-Design developed during the pre-conceptual stage and should be submitted during the conceptual design stage and updated and refined through the design process.

- The development, in the conceptual design stage, of facility-level DBAs that provide the necessary input to the identification and classification of important safety functions. These classifications (i.e., safety class, safety significant, natural phenomena hazard [NPH] design category) provide design expectations for SSCs.

- The development of the CSDR, PSDR, and PDSA. The intent of these reports and their approval is to ensure that the directions and decisions made regarding project safety are explicitly identified and dealt with in early stages of design. The objective is to reduce the likelihood of costly late reversals of design decisions involving safety.

Safety Basis Development during Nuclear Facility Lifecycle



References

The following references were used to develop the LOIs for SRP safety basis review during design. Also used were best management practices from field implementation.

1. 10 CFR 830, Subpart B, *Safety Basis Requirements*
2. 10 CFR 830, Subpart B, § 830.204, *Documented Safety Analysis*
3. 10 CFR 830, Subpart B, § 830.205, *Technical Safety Requirements*
4. 10 CFR 830, Subpart B, § 830.206 *Preliminary Documented Safety Analysis*
5. 10 CFR 830, Subpart B, § 830.207, *DOE Approval of Safety Basis*
6. DOE O 420.1C, *Facility Safety*, December 2012
7. DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, November 2010
8. DOE G 420.1-1A, Nonreactor Nuclear Safety Design Guide for Use with DOE O 420.1C, Facility Safety, December 2012
9. DOE-STD-1020-2012, *Natural Phenomena Hazard Analysis and Design Criteria for Department of Energy Facilities*, December 2012
10. DOE-STD-1027, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, Change Notice 1, September 1997
11. DOE-STD-1104, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*, May 2009[2]
12. DOE-STD-1073, *Configuration Management*, October 2003
13. DOE-STD-1189, *Integration of Safety into the Design Process*, March 2008
14. DOE-STD-3009, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, Change Notice 3, March 2006[3]

Safety Basis Program Review Lines of Inquiry During Design

The following four attachments contains LOIs for the review of safety basis process and documentation during: 1) conceptual design for CD-1 approval; 2) preliminary design for CD-2 approval; 3) final design for CD-3 approval; and 4) construction and commissioning prior to CD-4 approval and facility operations. The development of the SDS and COR are important parts of the Safety-into-Design strategy during the design process and they are contained in two stand-alone SRPs.

[2] DOE-STD-1104-2014, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*, was released in December 2014 and will be used for the update of the next version of the SRP.
[3] DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, was released in November 2014 and will be used for the update of the next version of the SRP.

Attachment 1 -- LOIs for Review of Safety Basis Process During Conceptual Design

Conceptual Design Stage LOIs[4]	Yes	No
General		
Was configuration management applied to assure that the design documents and the CSDR are consistent and up to date in accordance to DOE-STD-1073?		
Does the Safety-in-Design integration strategy include the interface organizations and activities identified in Table 7.1 of DOE-STD-1189, including the following? • Quality Assurance • Worker Safety and Health Program • Fire Protection • Infrastructure • Nuclear Criticality Safety • Radiological Protection • Human Factors • Security • Environmental Protection • Hazardous Material • Radiological and Hazardous Waste Management • Emergency Preparedness • External Reviews • System Engineer Program • Procedures, Training and Qualification Note: These safety program interfaces are part of the safety basis development in the conceptual design and they will be described and incorporated in the subsequent development of the PSDR/PDSA/DSA.		
Do these interfaces address the appropriate resource requirements and guidance as identified in Table 7.1?		
Is the process in DOE-STD-1189 used for the selection of safety controls at the facility level? Is it defined in the SDS? Note: See SDS LOIs in the SDS SRP.		

[4] These LOIs are based DOE requirements, Directives and technical standards including 10 CFR 830.204, 10 CFR 830.206, DOE O 413.3B, DOE O 420.1B, DOE-STD-1189, and DOE-STD-1104. They provide a starting point for a set of corporate Performance Expectations and Criteria. Review teams are expected to build on these and develop additional project-specific LOIs, as needed. See also LOIs for Safety Design Strategy review in the SDS SRP.

Conceptual Design Stage LOIs[4]	Yes	No
Does the CSDR contain justifications on decisions made with respect to the safety classification of the safety controls and associated functions?		
Has the Safety-in-Design Risk and Opportunity Assessment been developed?		
Does the Risk and Opportunity Assessment interface with the project Risk Management Plans consistent with the guidance and expectations identified in DOE-STD-1189, Appendix F?		
Was the Risk and Opportunity Assessment reviewed to verify that the technical uncertainties in the safety design basis are identified and that the CSDR identify risk handling strategies that bound each identified risk?		
Is the conceptual safety design basis reasonably conservative and the risk of significant redesign related to major or costly changes in safety controls minimized or properly documented in the CSDR?		
Does the CSDR contain a summary of the risks and opportunities associated with the safety design basis strategies?		
Does the CSDR identify any safety issues that require further study before the design can be advanced?		
CSDR Format and Content		
Does the CSDR meet the format and content guide from Appendix H in DOE-STD-1189-2008?		
Does the "Introduction" chapter of the CSDR address: 1) Facility and Mission Overview; and 2) Site Location?		
Does the “Conceptual Design Description” chapter address: 1) Facility Structure and Layout; and 2) Process Description?		
Does the “Preliminary Hazard Categorization” chapter address: 1) Hazardous Material Inventories; and 2) Comparison of Inventories to Threshold Quantities?		
Does the “Design Basis Accidents” chapter address: 1) Facility-Level DBAs; 2) Unmitigated DBA Analyses; and 3) Preliminary Selection and Classification of Safety SSCs?		
Does the “Security Hazards and Design Implications” chapter address the security requirements of the DOE 470 series Orders? Note: Security requirements, such as development of Design Basis Threat scenarios, can have an impact on the Safety-in-Design strategy.		

Conceptual Design Stage LOIs[4]	Yes	No
Does the "Nuclear Safety Design Criteria" chapter address: 1) Approach for Compliance with Design Criteria; and 2) Exceptions to Design Criteria as specified in DOE O 420.1C?		
Does the "Other Considerations" chapter address: 1) Planned Studies and Analyses; 2) Safety-in-Design Risks and Opportunities; and 3) Lessons Learned from Previous Experience Involving Major Systems?		
Hazard Analyses, Accident Analysis, and Control Selection		
Do the hazard analysis activities address Section 4.2 requirements of DOE-STD-1189?		
When design requirements are established, are alternatives evaluated to establish a process approach that includes facility and equipment arrangements?		
Do hazards analyses support the preliminary identification of the required safety functions as well as the preliminary set of SSCs?		
Has the hazards analysis been used to support preliminary identification of defense-in-depth or important to safety SSCs and provided to the design staff as appropriate?		
Are safety controls strategies for DBAs clearly identified in the hazard analysis?		
Does the DBA control strategy include required safety functions and classifications?		
Are the safety function classifications from Appendices A and B of DOE-STD-1189 appropriated applied, including NPH classifications?		
Does the CSDR provide the preliminary assessment of NPH design category for the facility structure and major SSCs?		
Does the DBA control strategy include NPH performance categories (non-seismic NPH) and seismic design bases for major SSCs?		
Are the hazards analysis process and the criteria for selection of safety SSCs appropriately conservative?		
Are the necessary inputs for the completion of the PHA provided and used in the PHA process including the following? • Facility site or location selection • General arrangement drawings • MAR estimates or assumptions and material flow balances		

Conceptual Design Stage LOIs[4]	Yes	No
• 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 • Confinement strategy		
Does the hazards analysis identify the high cost safety functions and design requirements for the SSCs that will be included in the project, including the following as appropriate? • Building structure • Building and process confinement • Power systems, including those associated with single failure criteria for safety class SSCs • Fire protection provisions • Special mechanical equipment (e.g., glove boxes)		
Is a preliminary FHA and its conclusions addressed in the CSDR in a manner that reflects all relevant fire safety objectives that could affect the facility safety basis?		
Does the CSDR address criticality safety concerns (e.g., safe geometry) and incorporate criticality criteria into the conceptual design?		
Are the hazards and quantities reviewed with respect to the Emergency Planning Hazards Assessment accordance to DOE O151.1C?		
Does the CSDR address radiological controls to achieve As Low as Reasonably Achievable as required by 10 CFR 835. Subpart K of 10 CFR 835, *Design and Control and Facility Design and Modifications*?		
Does the PHA establish an appropriate suite of DBAs to define functional and performance requirements for the facility design? Are the identified facility level DBAs appear to be a complete?		
Do the DBAs include internally initiated events such as: • Fire; • Explosion; • Loss of containment/confinement; • Process upsets; and • Inadvertent nuclear criticality?		
Is the basis of the chosen confinement strategy evaluated if a confinement strategy other than active ventilation was adopted (e.g. passive confinement)? Note: In general, an active safety class or safety- significant confinement system is preferred for hazard category 1 and 2 nuclear facilities unless otherwise indicated by the safety analyses.		

Conceptual Design Stage LOIs[4]	Yes	No
Do the DBAs include the appropriate externally initiated events? Do the DBAs consider the appropriate NPH initiated events?		
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?		
Are the safety controls selected in the CSDR consistent with the principles of the hierarchy of hazard controls -- passive engineering features, active engineering features, administrative controls, and then personal protective equipment?		
Is there appropriate conservatism in the determination of the safety-SSCs? Note: It is important that there be reasonable conservatism but it is equally important to avoid over conservatism which will drive an unnecessary number of safety systems from the CSDR.		
DOE Safety Review of CSDR		
Has the DOE SBAA reviewed and approved the CSDR and documented the DOE's evaluations in the CSVR? Has the Federal Project Director concurred the CSVR approval?		
Was the CSVR preparation consistency with the guidance provided in Section 5 of DOE-STD-1104?		
Does the CSVR confirms the following "safety positions" adopted for conceptual design as required by DOE-STD-1189? • Preliminary hazard categorization (HC-1, 2, or 3) of the facility • Preliminary identification of facility design basis accidents (DBA) • Assessment of the need for Safety Class (SC) and safety significant (SS) facility-level hazard controls based on preliminary hazards analyses and DBA • Preliminary assessment of the appropriate seismic design basis (seismic design category and limit state) for the facility structure and major hazard • controls • Position(s) taken with respect to compliance with the safety design criteria of DOE O 420.1B or any alternate criteria proposed.		
Was the DOE review adequate in depth and documentation to support approval of CD-1?		
Is the CSDR part of the approval package for CD-1 decision as required by DOE O 413.3B?		

Attachment 2 -- LOIs for Review of Safety Basis Process During Preliminary Design

Preliminary Design Stage LOIs[5]	Yes	No
General		
Has the CSDR been updated to a PSDR with the appropriate level of detail and depth based on the preliminary design?		
Was configuration management applied to assure that the design documents and the CSDR are consistent and up to date in accordance to DOE-STD-1073?		
Does the PSDR identify changes to the Safety-in-Design decisions and commitments described in the CSDR and provide explanations for the changes?		
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; and • Other developmental work that impact the risk assessment?		
Does the Safety-in-Design Opportunity Assessment interface with the project Risk Management Plans consistent with the guidance and expectations identified in DOE-STD-1189-2008, Appendix F?		
Was the Risk and Opportunity Assessment reviewed to verify that the technical uncertainties in the safety design basis are identified ?		
Does the PSDR identify the safety design risks and risk mitigation strategies for these risks?		
Is the preliminary safety design basis reasonably conservative and the risk of significant redesign related to major or costly changes in safety controls minimized or properly documented in the PSDR?		
Does the PSDR contain a summary of the updated risks and opportunities associated with the safety design basis strategies?		
Does the PSDR identify technical studies still needed to complete the safety design? Are they identified in sufficient depth and detail to ensure that the study will meet the project needs?		

[5] These LOIs are based DOE requirements, Directives and technical standards including 10 CFR 830.204, 10 CFR 830.206, DOE O 413.3B, DOE O 420.1B, DOE-STD-1189-2008, and DOE-STD-1104. They provide a starting point for a set of corporate Performance Expectations and Criteria. Review teams are expected to build on these and develop additional project-specific LOIs, as needed. See also LOIs for Safety Design Strategy review in the SDS SRP.

Preliminary Design Stage LOIs[5]	Yes	No
Does the Safety-in-Design integration strategy include the interface organizations and activities identified in Table 7.1 of DOE-STD-1189, including the following? • Quality Assurance • Worker Safety and Health Program • Fire Protection • Infrastructure • Nuclear Criticality Safety • Radiological Protection • Human Factors • Security • Environmental Protection • Hazardous Material • Radiological and Hazardous Waste Management • Emergency Preparedness • External Reviews • System Engineer Program • Procedures, Training and Qualification Note: These safety program interfaces are part of the safety basis development in the preliminary design and they will be described and incorporated in the subsequent development of the PDSA/DSA.		
Do these interfaces address the appropriate resource requirements and guidance as identified in Table 7.1?		
Is the process in DOE-STD-1189 used for the selection of safety controls at the system level? Is it defined in the updated SDS? Note: See SDS LOIs in the SDS SRP.		
Doe the PSDR contain justifications on decisions made with respect to the safety classification of the safety controls and associated functions?		
Does the PSDR list the major design codes, standards, regulations, and DOE Orders that are required for establishing adequate Safety-in-Design for the facility as required by DOE-STD-1189? Is the list of requirements consistent with the Code of Record as required by DOE O 413.3B?		
Does the PSDR identify technical studies still needed to complete the safety design? Are they identified in sufficient depth and detail to ensure that the study will meet the project needs?		
PSDR Format and Content		
Does the PSDR meet the format and content as identified in Appendix I of DOE-STD-1189? Note: The PSDR/PDSA format and content are designed to be built upon to produce the DSA.		

Preliminary Design Stage LOIs[5]	Yes	No
• Executive Summary • Chapter 1 -- Site Characteristics • Chapter 2 -- Facility Description • Chapter 3 -- Hazard Analyses, Accident Analysis, and Control Selection • Chapter 4 -- Safety Structures, Systems and Components for Preliminary Design • Chapter 5 -- Preliminary Derivation of Technical Safety Requirements • Chapter 6 -- Design of the Prevention of Inadvertent Criticality • Appendix A -- Safety Management Program Roadmap • Appendix B -- Design Approach to Address DOE O 420.1C Design Requirements		
If the DOE-STD-1189 PSDR format and content is not used, does the SDS define an alternative approach? Has the alternative approach been reviewed and approved by DOE?		
Does the Executive Summary provide an overview of the Safety-in-Design approach including: 1) Facility Mission; 2) Facility Overview; 3) Facility Hazard Characterization; 4) Safety Analysis Overview; 5) Organizations; 6) Safety-in-Design Conclusions; and 7) Document Organizations?		
Does the “Site Characteristics” chapter address: 1) Site Description; 2) Environmental Description; 3) Natural Event Accident Initiators; 4) Man-Made External Accident Initiators; 5) Nearby Facilities; and 6) Evaluation of Siting Criteria?		
Does the "Facility Description" chapter address: 1) Requirements for establishing adequate Safety-in-Design for the facility; 2) Facility Overview; 3) Facility Structure; 4) Process Description; 5) Summary of SC and SS SSCs; 6) Utility Distribution Systems; 7) Auxiliary Systems and Support Facilities; and 8) Design Provisions for Decontamination and Decommissioning?		
Does the "Hazard Analyses, Accident Analysis, and Control Selection" chapter address: 1) Methodology; 2) Hazard Analysis Results; 3) Facility Hazard Categorization; 4) Results of Accident Analysis; 5) Summary of Significant Facility Worker Hazards and Controls; 6) Summary of Safety Functions and SSCs and SACs; and 7) Accidents Beyond Design Basis?		
Does the "Safety SSCs for Preliminary Design" chapter describe the: 1) SC SSCs; 2) SS SSCs; and 3) SACs?		
Does the "Preliminary Derivation of TSRs" chapter describe the: 1) TSR Coverage; 2) Derivation of Facility Modes; 3) TSR Derivation; and 4) Design Features?		
Does the "Design of Prevention of Inadvertent Criticality" chapter address criticality concerns and criticality controls?		
Does the PSDR summarize information relevant to criticality control, including engineering, administrative, and application of double contingency principle?		

Preliminary Design Stage LOIs[5]	Yes	No
Does the "Safety Management Program Roadmap" in Appendix A describe the safety management programs that are needed to support safe operations?		
Does the "Design Approach to Address DOE O 420.1C Design Requirements" in Appendix B provide an updated requirement crosswalk developed in CSDR to demonstrate application and implementation of the nuclear safety design criteria?		
Hazard Analyses, Accident Analysis, and Control Selection		
Did the hazard analysis activities address the requirements of Section 4.3 of DOE-STD-1189-2008?		
Does the PSDR provide a summary of the hazard analysis results and reference supporting hazard analysis reports, if any?		
Does the PSDR present the results of the hazard categorization activity specified in DOE-STD-1027? Was the facility hazard categorization updated from the conceptual design stage?		
Has the updated FHA and its conclusions been updated in a manner that reflects all relevant fire safety objectives that could affect the facility safety basis?		
Does the PSDR include information regarding aspects of the preliminary design that are required to support the prevention of criticality?		
Are the hazards and quantities reviewed with respect to the Emergency Planning Hazards Assessment accordance to DOE O151.1C?		
Was the analysis of the DBAs identified in the conceptual design updated to confirm the selection of system-level hazard controls and their functional classifications?		
Was a system-level hazard analysis performed and used to select and classify hazard controls for the facility worker?		
Does the updated hazard analysis include consideration of beyond DBA events?		
Were the appropriate hazard analysis 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?		

Preliminary Design Stage LOIs[5]	Yes	No
Have the engineering drawings been updated from the conceptual design stage and they are used for the safety basis development? Are they in place in configuration management control?		
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?		
Does the HA evaluate potential accident consequences to the public and workers?		
Does the HA identify and assess associated preventative and mitigative features including classification (e.g. safety class, safety significant, etc.)?		
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?		
Was a graded approach applied to the HA process based on the magnitude and complexity of the hazards of the facility?		
Are design details for safety SSCs developed that incorporate design requirements derived from the HA, the updated DBA analysis and the governing requirements?		
Does the HA indicate whether the facility contains significant chemical hazards that necessitate DBA analysis for consideration of SSCs?		
Does the PSDR provide general requirements for safety SSCs including: • Conservative design features • Design against single point failure • Environmental qualification • Safe failure modes?		
Based on the functional classification and the safety SSC design function, does the PSDR specify appropriate codes and standards for the SSCs?		
Does the PSDR summarize information relevant to criticality control, including engineering, administration, and application of double contingency principle?		
Does the PSDR identify implementation of appropriate supplemental design criteria for safety SSCs per DOE G 420.1-1A?		

Preliminary Design Stage LOIs[5]	Yes	No
DOE Safety Review of PSDR		
Has the DOE SBAA reviewed and approved the PSDR and documented the DOE's evaluations in the PSVR? Has the Federal Project Director concurred on the PSVR approval?		
Is the PSDR part of the approval package for CD-2 decision as required by DOE O 413.3B?		
Was the DOE review adequate in depth and documentation to support approval of CD-2?		

Attachment 3 -- LOIs for Review of Safety Basis Process During Final Design

Final Design Stage LOIs[6] before CD-3	Yes	No
General		
Has the PSDR been updated to a PDSA with the appropriate level of detail and depth based on the final design? Note: PDSA is a requirement of 10 CFR § 830.206.		
Was configuration management applied to assure that the design documents and the PDSA are consistent and up to date in accordance to DOE-STD-1073?		
Does the PDSA identify changes to the Safety-in-Design decisions and commitments described in the PSDR and provide explanations for the changes?		
Has the Safety-in-Design Risk and Opportunity Assessment from the preliminary design phase been updated?		
Does the update reflect the results of: • Technical studies completed; • Design modifications; and • Other developmental work that impact the risk assessment?		
Does the Safety-in-Design Opportunity Assessment interface with the project Risk Management Plans consistent with the guidance and expectations identified in DOE-STD-1189-2008, Appendix F?		
Was the Risk and Opportunity Assessment reviewed to verify that the technical uncertainties in the safety design basis are identified ?		
Does the PDSA identify the safety design risks and risk mitigation strategies for these risks?		
Is the final safety design basis reasonably conservative and the risk of significant redesign related to major or costly changes in safety controls minimized or properly documented in the PDSA?		
Does the PDSA contain a summary of the updated risks and opportunities associated with the safety design basis strategies?		
Does the PDSA identify technical studies still needed to complete the safety design? Are they identified in sufficient depth and detail to ensure that the study will meet the project needs?		

[6] These LOIs are based DOE requirements, Directives and technical standards including 10 CFR 830.204, 10 CFR 830.206, DOE O 413.3B, DOE O 420.1B, DOE-STD-1189-2008, and DOE-STD-1104. They provide a starting point for a set of corporate Performance Expectations and Criteria. Review teams are expected to build on these and develop additional project-specific LOIs, as needed. See also LOIs for Safety Design Strategy review in the SDS SRP.

Final Design Stage LOIs[6] before CD-3	Yes	No
Does the Safety-in-Design integration strategy include the interface organizations and activities identified in Table 7.1 of DOE-STD-1189, including the following? • Quality Assurance • Worker Safety and Health Program • Fire Protection • Infrastructure • Nuclear Criticality Safety • Radiological Protection • Human Factors • Security • Environmental Protection • Hazardous Material • Radiological and Hazardous Waste Management • Emergency Preparedness • External Reviews • System Engineer Program • Procedures, Training and Qualification Note: These safety program interfaces are part of the safety basis development in the earlier design stages and they will be described and incorporated in the subsequent development of the DSA.		
Do these interfaces address the appropriate resource requirements and guidance as identified in Table 7.1?		
Is the process in DOE-STD-1189 used for the selection of safety controls at the system level? Is it defined in the SDS? Note: See SDS LOIs in the SDS SRP.		
Does the PDSA contain justifications on decisions made with respect to the safety classification of the safety controls and associated functions?		
Does the PDSA list the major design codes, standards, regulations, and DOE Orders that are required for establishing adequate Safety-in-Design for the facility as required by DOE-STD-1189? Is the list of requirements consistent with the Code of Record as required by DOE O 413.3B?		
Does the PDSA identify changes to the Safety-in-Design decisions and commitments described in the PSDR and provide explanations for the changes?		
Does the PDSA address resolution of technical issues that required performance of research or other data collection to finalize the design?		
Does the PDSA document preliminary approaches to facility startup and operations management?		

Final Design Stage LOIs[6] before CD-3	Yes	No
Does the PDSA demonstrate the adequacy of the design by demonstrating that the safety design requirements specified at the end of the preliminary design have been satisfied?		
Does the material presented in the PDSA support the transition from PDSA to a DSA in accordance DOE-STD-3009?		
PDSA Format and Content		
Does the PDSA meet the format and content as identified in Appendix I of DOE-STD-1189? Note: The PDSA format and content are designed to be built upon to produce the DSA and as follows. • Executive Summary • Chapter 1 -- Site Characteristics • Chapter 2 -- Facility Description • Chapter 3 -- Hazard Analyses, Accident Analysis, and Control Selection • Chapter 4 -- Safety Structures, Systems and Components for Preliminary Design • Chapter 5 -- Preliminary Derivation of Technical Safety Requirements • Chapter 6 -- Design of the Prevention of Inadvertent Criticality • Appendix A -- Safety Management Program Roadmap • Appendix B -- Design Approach to Address DOE O 420.1C Design Requirements Note: Safety Management Program information in Appendix A will be used to develop the safety management chapters of the DSA.		
If the DOE-STD-1189 PDSA format and content is not used, was the alternative approach described in the updated SDS? Note: Since the DOE-STD-1189 PDSA format and content will evolve into the DSA formant and content required by DOE-STD-3009, the contractor needs to provide justifications if another format and content alternative is used.		
Does the Executive Summary provide an overview of the Safety-in-Design approach including: 1) Facility Mission; 2) Facility Overview; 3) Facility Hazard Characterization; 4) Safety Analysis Overview; 5) Organizations; 6) Safety-in-Design Conclusions; and 7) Document Organizations?		
Does the “Site Characteristics” chapter address: 1) Site Description; 2) Environmental Description; 3) Natural Event Accident Initiators; 4) Man-Made External Accident Initiators; 5) Nearby Facilities; and 6) Evaluation of Siting Criteria?		
Does the "Facility Description" chapter address: 1) Requirements for establishing adequate Safety-in-Design for the facility; 2) Facility Overview; 3) Facility Structure; 4) Process Description; 5) Summary of SC and SS SSCs; 6) Utility Distribution Systems; 7) Auxiliary Systems and Support Facilities; and 8) Design Provisions for Decontamination and Decommissioning?		
Does the "Hazard Analyses, Accident Analysis, and Control Selection" chapter address: 1) Methodology; 2) Hazard Analysis Results; 3) Facility Hazard Categorization; 4) Results of Accident Analysis; 5) Summary of Significant Facility Worker Hazards and Controls; 6) Summary of Safety Functions and		

Final Design Stage LOIs[6] before CD-3	Yes	No
SSCs and SACs; and 7) Accidents Beyond Design Basis?		
Does the "Safety SSCs for Preliminary Design" chapter describe the: 1) SC SSCs; 2) SS SSCs; and 3) SACs?		
Does the "Preliminary Derivation of TSRs" chapter describe the: 1) TSR Coverage; 2) Derivation of Facility Modes; 3) TSR Derivation; and 4) Design Features?		
Does the "Design of Prevention of Inadvertent Criticality" chapter address criticality concerns and criticality controls?		
Does the PDSA summarize information relevant to criticality control, including engineering, administration, and application of double contingency principle?		
Does the "Safety Management Program Roadmap" in Appendix A describe the safety management programs that are needed to support safe operations?		
Does the "Design Approach to Address DOE O 420.1C Design Requirements" in Appendix B provide an updated requirement crosswalk developed in the CSDR to demonstrate application and implementation of the nuclear safety design criteria?		
Have the engineering drawings been updated from the preliminary design and they are used for the safety basis development?		
Hazard Analyses, Accident Analysis, and Control Selection		
Does the PDSA address the methodology used to perform hazard analysis, accident analysis, DBA analysis, and control selection? Note: The PDSA is expected to address activity-level hazard/accident analyses and controls while the CSDR addresses facility-level and the PSDR addresses system/process-level .		
Does the PDSA demonstrate that the mitigated conditions for hazards and accidents with hazard controls applied are below the Evaluation Guidelines?		
Does the PDSA provide a summary of the hazard analysis results and reference supporting hazard analysis reports, if any?		
Does the PDSA present the results of the hazard categorization activity specified in DOE-STD-1027?		
Has the FHA and its conclusions been updated in a manner that reflects all relevant fire safety objectives that could affect the facility safety basis?		
Does the PDSA include information regarding aspects of the final design that are required to support the prevention of criticality?		

Final Design Stage LOIs[6] before CD-3	Yes	No
Does the PDSA describe each analyzed accident with a focus on the facility and selected system levels? Does the accident analyses address unmitigated consequences, DBAs, and accident environmental conditions?		
Does the PDSA summarize the significant facility worker hazards and controls?		
Does the PDSA provide a summary listing the safety functions and the corresponding SSCs and SACs?		
Does the PDSA address accidents beyond the design basis and the impact to the facility design?		
Does the PDSA provide the unmitigated accident consequences for the design basis accidents and use this information to determine the appropriate functional classification (safety class or safety significant) and performance criteria?		
Does the PDSA demonstrate a viable design solution with safety SSCs and safety functions developed in accordance with the hazard and accident analyses?		
Does the PDSA provide general requirements for safety SSCs including: • Conservative design features • Design against single point failure • Environmental qualification • Safe failure modes?		
Based on the functional classification and the safety SSC design function, does the PDSA specify appropriate codes and standards for the SSCs?		
Does the PDSA summarize information relevant to criticality control, including engineering, administration, and application of double contingency principle?		
Does the PDSA include roadmap of project documentation addressing design aspects related to the effective implementation of safety management programs?		
Does the PDSA provide an updated structure and system-level crosswalk developed in the CSDR to demonstrate application and implementation of the nuclear safety design criteria of DOE O 420.1C or DOE-approved alternate criteria?		
Does the PDSA describe how the selected controls adequately prevent or mitigate accidents and provide sufficient defense in depth?		
Has the PDSA been maintained and does it reflect the current design?		

Final Design Stage LOIs[6] before CD-3	Yes	No
DOE Safety Review of PDSA		
Has the DOE SBAA reviewed and approved the PDSA and documented the DOE's evaluations in the SER? Has the Federal Project Director concurred on the SER approval?		
Was the SER developed based on DOE-STD-1104? Note: See SER LOIs in Volume 5 of this SRP.		
Is the PDSA and SER part of the approval package for CD-3 decision as required by DOE O 413.3B?		
Was the DOE review adequate in depth and documentation to support approval of CD-3?		

Attachment 4 -- LOIs for Review of Safety Basis Process Before Operations

Safety Basis Review LOIs[7] before CD-4 Approval of Start of Operations	Yes	No
Has the PDSA been updated to a DSA with the appropriate level of detail and depth based on the final design/as-build conditions and operations assessment? Note: DSA is a requirement of 10 CFR § 830.204.		
Does the DSA include the analysis of operational hazards and any upset conditions that were not considered in the PDSA?		
Was facility operations personnel involved in the DSA operational hazards analyses?		
Were personnel representing the operations organization involved in the preparation of the TSRs?		
Has a facility specific USQ program been developed and implemented?		
Was configuration management applied to assure that the design documents and the DSA/TSR are consistent and up to date in accordance to DOE-STD-1073?		
Have changes in the design (since the design submittal as part of CD-3) been identified and tracked under a change control process to ensure that they are incorporated into the DSA?		
Has the contractor completed a final review/verification of the facility configuration against the DSA prior to submittal to DOE?		
Does the DSA include the required crosswalk between the safety design requirements and the guidance of DOE O 420.1C (see Appendix B of Appendix I of STD-1189)?		
Are the requirements, codes and standards identified in the DSA consistent with those in the COR?		
Does the DSA address all the issues identified from reviews during construction, checkout, testing and commissioning?		
Does the DSA address all the issues identified during Operational Readiness Review or Readiness Review?		
Does the DSA meet the format and content as identified in DOE-STD-3009? Note: The LOIs for the review of the DSA are contained in Volume 3 of this SRP.		

[7] These LOIs are based DOE requirements, Directives and technical standards including 10 CFR 830.204, 10 CFR 830.206, DOE O 413.3B, DOE O 420.1B, DOE-STD-1189-2008, and DOE-STD-1104. They provide a starting point for a set of corporate Performance Expectations and Criteria. Review teams are expected to build on these and develop additional project-specific LOIs, as needed. See also LOIs for Safety Design Strategy review in the SDS SRP.

Safety Basis Review LOIs[7] before CD-4 Approval of Start of Operations	Yes	No
If the DOE-STD-3009 DSA format and content are not used, did the SDS define an alternative approach for DOE approval during conceptual or preliminary design stages? Note: Since the DOE-STD-1189 PDSA format and content will evolved into the DSA formant and content required by DOE-STD-3009, the contractor needs to provide justifications if other format and content alternative is used.		
Has the DOE SBAA reviewed and approved the DSA and TSR and documented the DOE's evaluations in the SER? Has the Federal Project Director concurred on the SER approval?		
Have COAs been used to document any changes, conditions, or hazard controls directed by DOE? Do COAs include a defined closure date?		
Have any COAs from the SER been addressed and closed either prior to or as part of the DSA submittal?		
Are the DSA, TSR, and SER part of the approval package for CD-4 decision as required by DOE O 413.3B? Note: See Volume 5 of this SRP for LOIs for the review of TSR, USQ, and SER.		
Has the contractor developed an implementation plan or process for implementation of the final DSA and associated TSRs once approved by DOE?		
Was the DOE review adequate in depth and documentation to support approval of CD-4 and preparation for facility operations?		