CNS

OFFICE OF THE UNDER SECRETARY

Strengthening Line Management Oversight and Federal Monitoring of Nuclear Facilities

Standard Review Plan

Volume 1 -- Nuclear Safety Basis Program Review Overview and Management Oversight

February 2015

Standard Review Plan

Volume 1

Nuclear Safety Basis Program Review

Overview and Management Oversight

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

February 2015

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Acronyms

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
HA	Hazard Analysis
ISM	Integrated Safety Management
JCO	Justification for Continued Operation
LOI	Line of Inquiry
PAAA	Price Anderson Amendments Act
PDSA	Preliminary Documented Safety Analysis
PHA	Preliminary Hazards Analysis
PSDR	Preliminary Safety Design Report
PSVR	Preliminary Safety Validation Report
QA	Quality Assurance
SBAA	Safety Basis Approval Authority
SDS	Safety Design Strategy
SER	Safety Evaluation Report
SRP	Standard Review Plan
SSC	Structures, Systems and Components
TEDE	Total Effective Dose Equivalent
TSR	Technical Safety Requirements
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination

Introduction

The DOE Nuclear Safety Management regulation (10 CFR Part 830) establishes requirements related to management systems and processes that are needed to ensure quality and safety are integrated into nuclear facility life cycle, which include facility design, construction, commissioning, operations, transitions, decommissioning, and environmental restoration. Safety basis requirements are addressed in Subpart B of the regulation. Safety basis is defined as the "the documented safety analysis and hazard controls that provide reasonable assurance that a DOE nuclear facility can be operated safely in a manner that adequately protects workers, the public and the environment."

The quality and completeness of safety basis documents is a reflection of the institutional management systems and processes that direct or influence the preparation and review of facility safety bases. Important attributes include incorporating safety basis requirements into contract provisions and performance fee plans; establishing and implementing contractor procedures that are compliant with 10 CFR 830, Subpart B, as related to preparation, implementation, and maintenance of safety basis documents and controls; establishing procedures within DOE field offices for reviewing and assessing safety basis documents and processes; and training and qualification of both contractor and DOE field office personnel performing safety basis functions. These activities are subject to routine DOE headquarters and field office oversight and assessments and it is important to review safety basis development process and documentation during all phases of the facility life cycle.

The outputs of the safety basis process form a type of "license" by which DOE authorizes the contractor to conduct nuclear operations and includes the DSA, TSR, SER and contractor USQ process. During the nuclear project design phases, integrating safety into the design helps reduce the likelihood of costly late reversals of design decisions involving safety. The safety design documents include CSDR, PSDR, and PDSA. The quality of these documents, and the hazard controls that are embedded and protected within the safety basis are dependent on the quality of the contractor and management systems and processes by which safety bases are prepared, reviewed and maintained.

This SRP, *Nuclear Safety Basis Program Review*, consists of five volumes. It provides information to help strengthen the technical rigor of line management oversight and federal monitoring of DOE nuclear facilities.[1] It provides a primer on the safety basis development and documentation process used by the DOE. It also provides a set of LOIs for the review of safety

[1] To help strengthen all areas of management oversights and federal monitoring, other SRPs were developed by the Chief of Nuclear Safety. These SRPs include: 1) SRP for the applications of engineering requirements for the design, operations, and decommissioning of DOE nuclear facilities; 2) SRP for the applications of DOE Critical Decision requirements from DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, and DOE-STD-1189-2008, *Integration of Safety into the Design Process; 3) SRP Senior Management Handbook for the applications of DOE Critical Decision requirements;* and 3) special focused SRPs including Code of Record, Safety Design Strategy, Commercial Grade Dedication, and Preparation for Facility Operations.

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 safety basis directives and technical standards, as well as from best management practices. The LOIs provides 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.

Overview of Safety Basis Process for Nuclear Facilities

The overall safety basis development process for the nuclear facility life cycle is depicted in Figure 1. Safety bases are developed through a formal process that requires a systematic identification and analysis of hazards, establishment of controls, and the formal documentation of these results. The process is consistent with the DOE ISM Core Functions. Figure 1A describes the hazard analysis step of the nuclear safety basis process. Figure 1B describes the accident analysis step. Figure 1C describes the safety controls determination step. Figure 1D describes the key safety basis documents developed from the nuclear safety process. Figure 1E describes the USQ element of the safety basis program. Continuous interface between the DOE and contractor is an essential part of the safety basis process.

Figure 1 - Safety Basis Process and Documentation

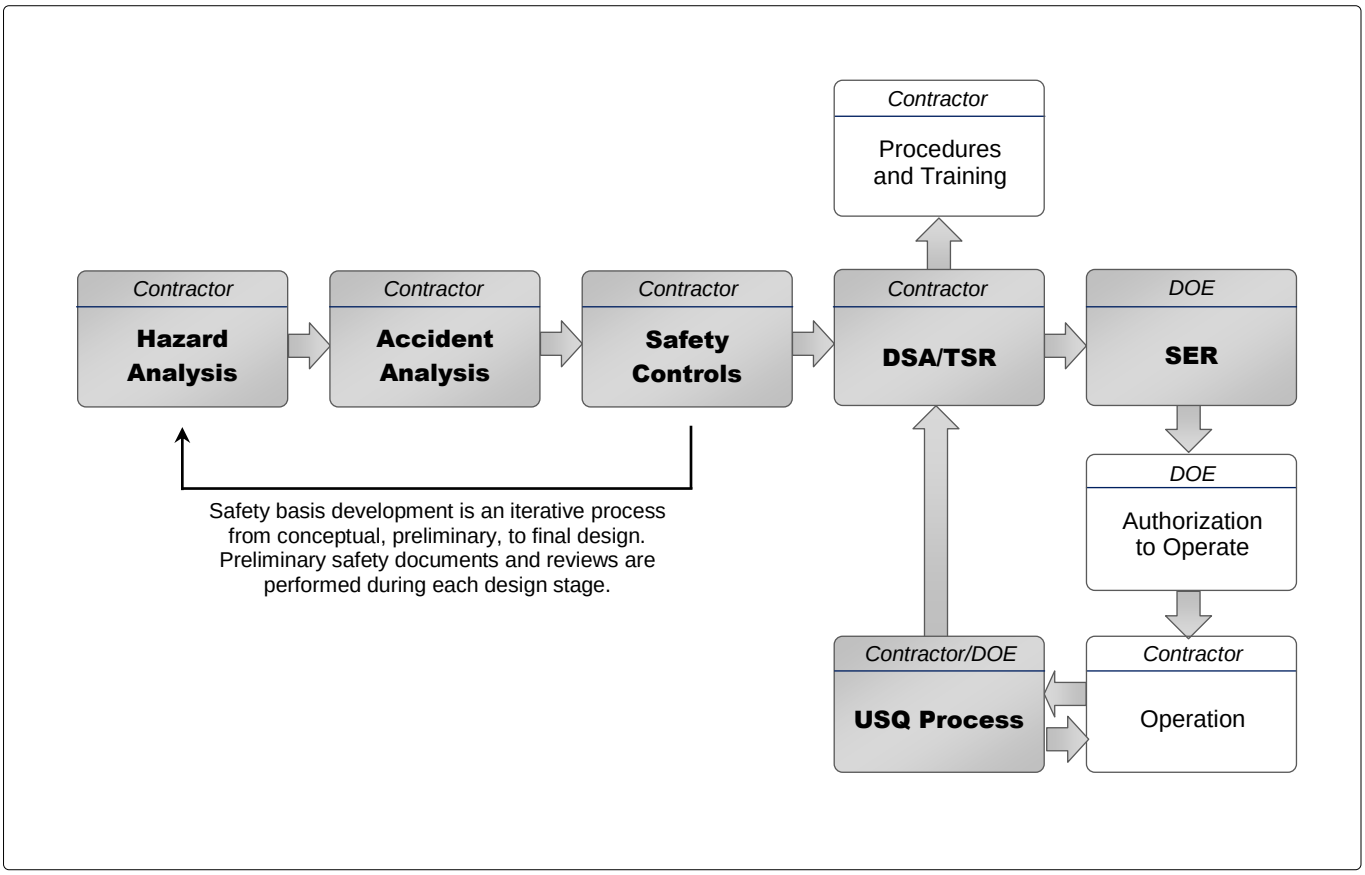
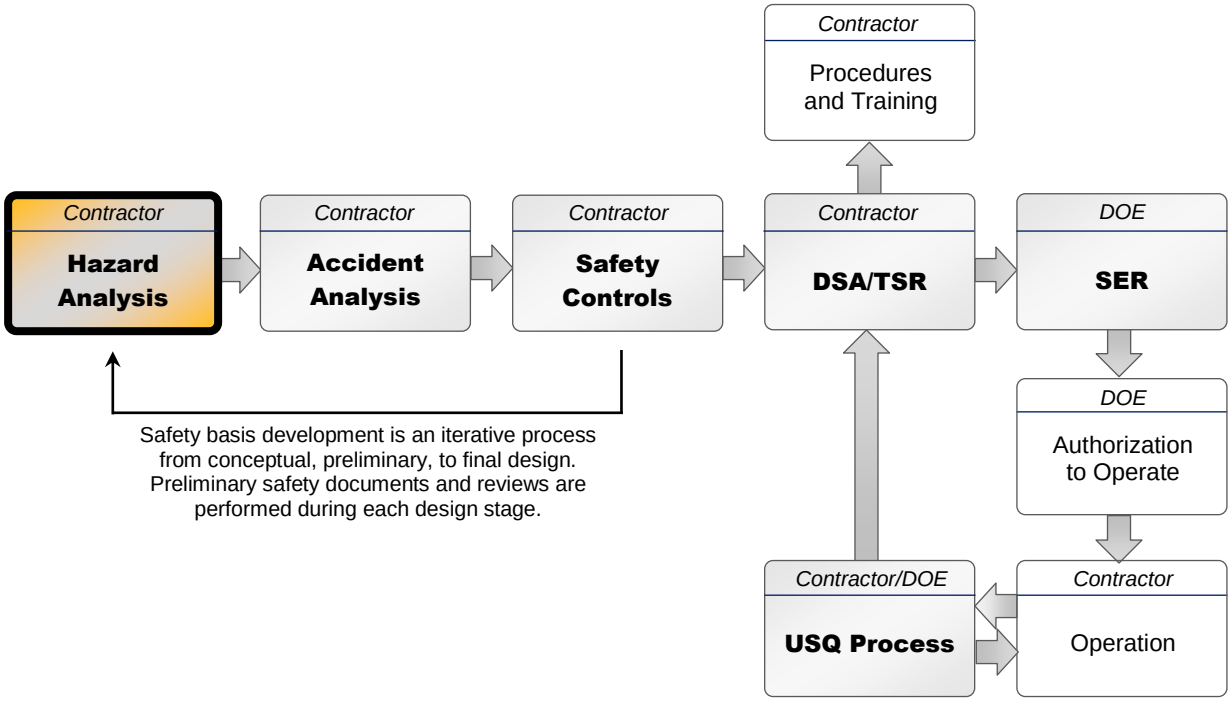


Figure 1A - Hazards Analysis

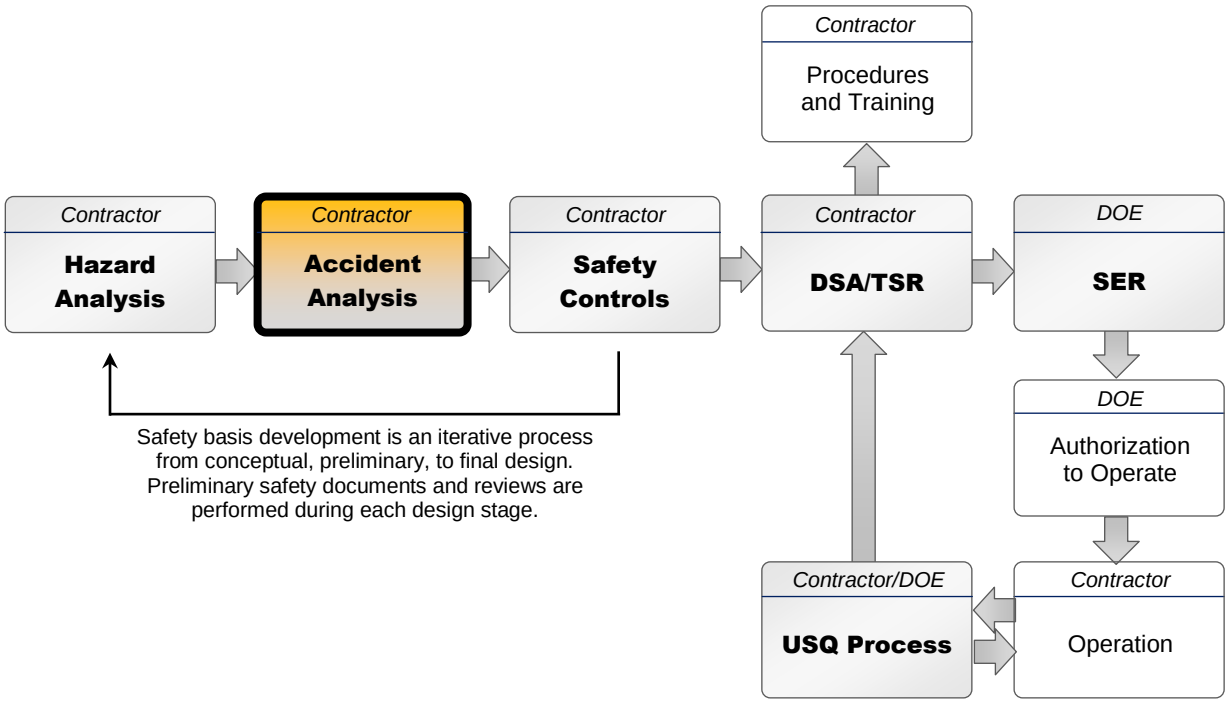


- Hazard identification is the initial step in the safety basis development process which covers all hazards and is mainly qualitative.
- DOE classifies its facilities based on total inventory of hazardous materials
  - Category 1 – Potential for significant offsite consequences
  - Category 2 – Potential for significant onsite consequences or criticality
  - Category 3 – Potential for only significant localized consequences
- Hazards are evaluated to provide an evaluation of the spectrum of risks to the public, workers, and the environment, and to identify preventative and mitigative features for the event.
- Hazards are analyzed to identify a limited set of bounding accident scenarios for further evaluation to be included in accident analysis.
- DOE uses facility categorization to:
  - Prioritize resources
  - Apply graded approach to analysis and documentation requirements
  - Define approval levels

Definition:

Hazard: A source of danger (i.e., nuclear/chemical material, energy source, or operation) with the potential to cause illness, injury, or death to a person or damage to a facility or to the environment (without regard to the likelihood and consequence). Examples: toxicity, flammability, reactivity, elevated pressure, radioactivity.

Figure 1B - Accident Analysis



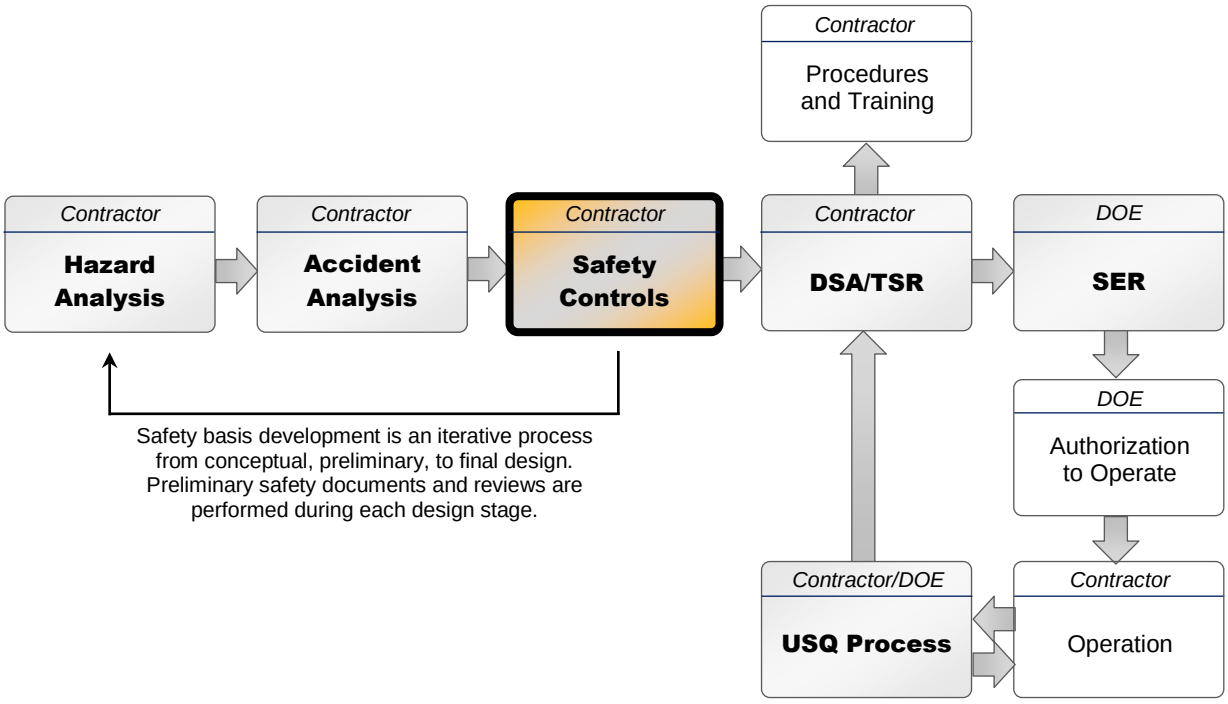
- The next step in the safety basis process is the analysis of the limited set of bounding accidents and consequences.

- Accident analysis postulates accidents for each hazard by:

  - Identifying initiating events (fire, explosion, mechanical failure, human errors, external events, etc.)
  - Developing accident scenarios and documenting major assumptions, including barrier identification and challenges to barriers in a facility
  - Determining the source terms that can be released into the environment
  - Performing consequence analysis and quantifying the consequences of accidents with the purpose of comparing them to the Evaluation Guidelines

- Based on the graded approach, Hazard Category 3 facilities typically do not require a formal, quantitative accident analysis to be performed. Instead, hazard analysis is sufficient to meet the 10 CFR 830 requirements for accident analysis.

Figure 1C – Safety Controls Determination



- Compare consequence results with the EGs

- Identify special limits, controls and hardware to meet the EGs

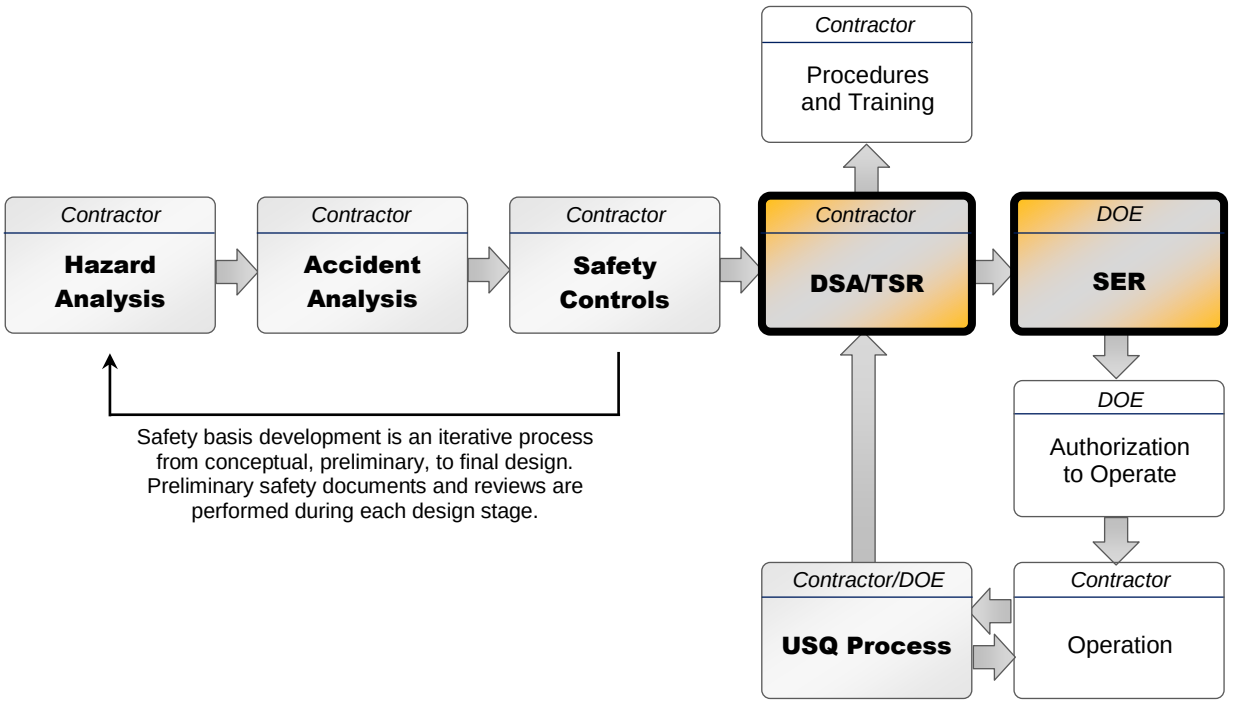
  - Safety limits, limiting conditions of operations, administrative controls, design features: Develop Technical Safety Requirements
  - Special hardware:
    Identify "Safety Class" and "Safety Significant" SSCs. Higher level of QA, procurement, material construction and safety review are required for the identified SSCs.

Definition:

Safety Class SSCs: SSCs whose failure would result in a consequence challenging the EG value of 25 rem TEDE at the site boundary.

Safety Significant SSCs: SSCs whose failure could result in an acute worker fatality or serious injury to worker, or affect Defense-In-Depth.

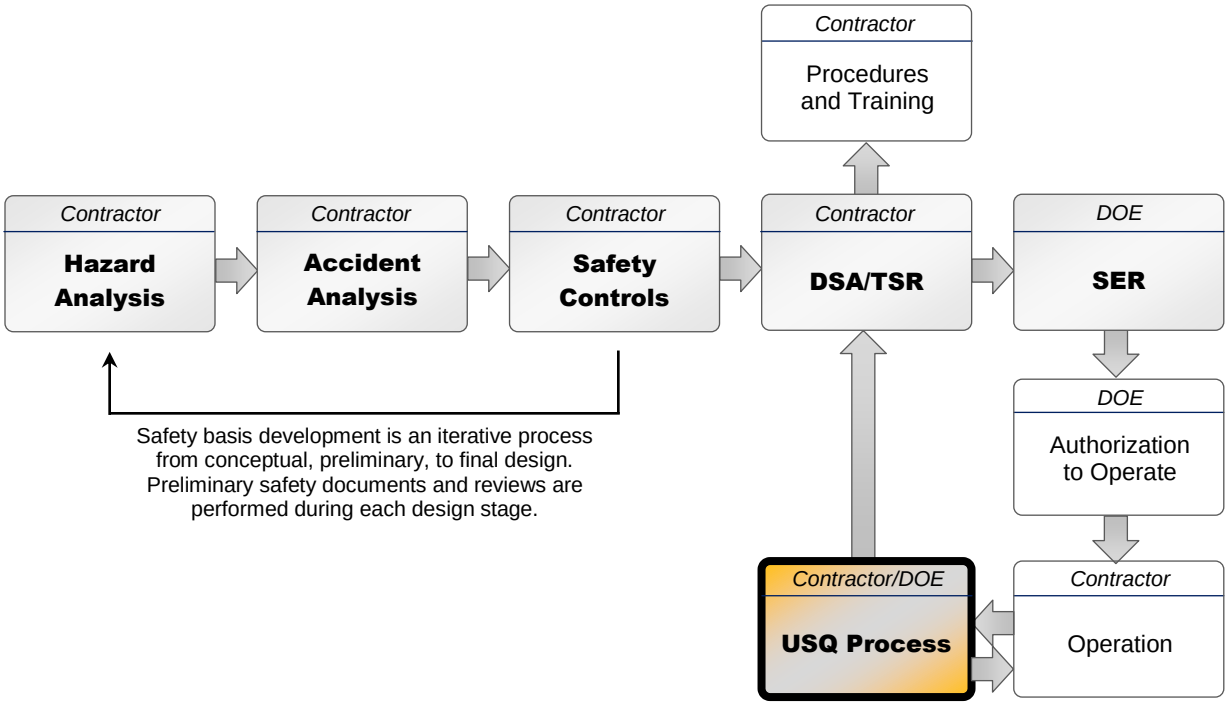
Figure 1D - Safety Basis Documents



DSA	TSR	SER
▪ Prepared by Contractor ▪ Executive Summary ▪ Site Characteristics ▪ Facility Description ▪ Hazard and Accident Analysis ▪ Safety Structures, Systems, and Components ▪ Derivation of Technical Safety Requirements ▪ Prevention of Inadvertent Criticality ▪ Radiation and Hazardous Waste Management ▪ Initial Testing, In-Service Surveillance, and Maintenance ▪ Operational Safety ▪ Procedures and Training ▪ Human Factors ▪ Quality Assurance ▪ Emergency Preparedness Program ▪ Provisions for Decontamination and Decommissioning ▪ Management Organization, and Institutional Safety Provisions	▪ Prepared by Contractor ▪ Use and Application ▪ Safety Limits ▪ Limiting Control Settings, Limiting Conditions of Operations, and Surveillance Requirements ▪ Administrative Controls[2] ▪ Design Features ▪ Bases Appendix	▪ Prepared by DOE ▪ Management and Coordination of Safety Basis ▪ Approval Bases of Documented Safety Analyses ▪ Approval Bases for Technical Safety Requirements ▪ Safety Design Basis Documents **SER Contents** ▪ Signature page ▪ Executive Summary ▪ Review Process ▪ Best Information ▪ Hazard and Accident Analysis ▪ Safety Structure, Systems, and Components ▪ Derivation of Technical Safety Requirements ▪ Safety Management Program Characteristics ▪ Technical Safety Requirements ▪ Conditions of Approval ▪ Records

[2] Administrative controls are provisions relating to organization and management procedures, record keeping, assessment, and reporting necessary to ensure the safe operation of a facility. An administrative control is designated as a Specific Administrative Control if (1) it is identified in the documented safety analysis as a control needed to prevent or mitigate an accident scenario, and (2) it has a safety function that would be safety significant or safety-class if the function were provided by an SSC.

Figure 1E - USQ Process



- The USQD process allows contractors to make physical and procedural changes (temporary or permanent) and to conduct tests and experiments without prior DOE approval, as long as operation is within the safety basis envelope.

- The USQ process is also applicable when the project identifies situations where it is apparent that the existing safety basis may not be bounding or may be otherwise inadequate (Potential Inadequacy of the Safety Analysis).

- The USQD uses the seven-step evaluation to determine if the operation is within the safety basis envelope, which includes:

  - Probability of an occurrence or consequence of an accident could be increased
  - Probability of an occurrence or consequence of an equipment malfunction could be increased
  - Possibility that a new accident or malfunction of equipment could be created
  - A margin of safety could be reduced

- If the USQD shows a positive USQ, the contractor needs DOE approval prior to implementing corrective actions.

- Contractor makes the corrective actions and updates the safety basis.

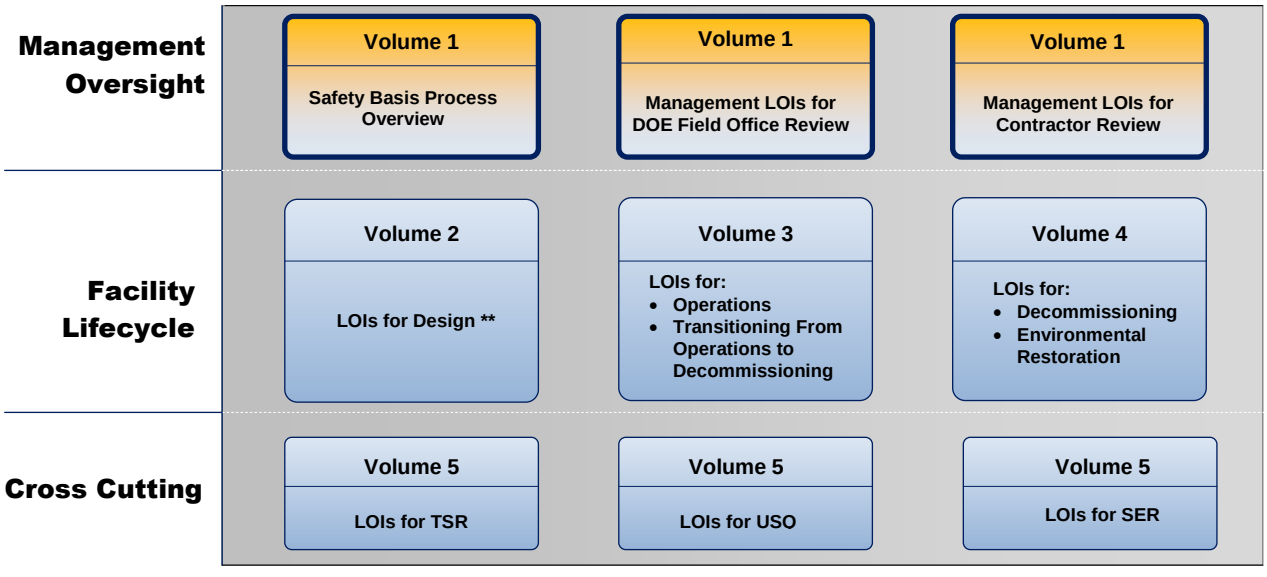
Safety Basis Program Review Lines of Inquiry

The contents of the five volumes of this SRP are described in Figure 2. Volume 1 contains an overview of the nuclear safety basis process and contains the LOIs for management review of the safety basis programs of the DOE Field Offices and contractors. These LOIs address:

- Safety Basis Policies and Procedures
- Staff Qualification and Training of Safety Basis Personnel
- Staffing
- Safety Basis Development, Implementation and Maintenance
- Safety Basis Review and Approval

Volumes 2 through 4 contains LOIs for a more detailed technical review of the safety basis development and documentation process to assure that safety is integrated early into the design and the facilities can operate and decommission safely. During facility design, safety basis analyses and documentation are performed commensurate with the conceptual, preliminary, and final designs. The safety basis analysis and documentation is maintained during facility startup/commissioning, operations, transition, decommissioning and environmental restoration. Volume 5 contains LOIs applicable to all the facility lifecycle phases. These LOIs address the review of TSRs, SER, and USQ process. The USQ process is important since it requires a documented evaluation of proposed changes and discovery conditions to determine whether activities are or could be outside the facility safety envelope established in the DSA.

Figure 2 – Contents of SRP on Nuclear Safety Basis Program Review



** 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.

References

The following references were used to develop the LOIs contained in the five volumes of this SRP. Also used were best management practices from field implementation.

1. 10 CFR 830, Subpart B, *Safety Basis Requirements*
2. 10 CFR 830, Subpart B, § 830.203, *Unreviewed Safety Question Process*
3. 10 CFR 830, Subpart B, § 830.204, *Documented Safety Analysis*
4. 10 CFR 830, Subpart B, § 830.205, *Technical Safety Requirements*
5. 10 CFR 830, Subpart B, § 830.206 *Preliminary Documented Safety Analysis*
6. 10 CFR 830, Subpart B, § 830.207, *DOE Approval of Safety Basis*
7. DOE O 151.1C, *Comprehensive Emergency Management System*, November 2005
8. DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, November 2010
9. DOE O 414.1D, Admin Chg 1, *Quality Assurance*, May 2013
10. DOE O 420.1C, *Facility Safety*, December 2012
11. DOE O 422.1, Chg 2, *Conduct of Operations*, December 2014
12. DOE O 462.1, *Federal Technical Capability*, September 2011
13. DOE-O 426.2, Chg 1, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*, July 2013
14. DOE O 430.1B, Chg 2, *Real Property and Asset Management*, September 2003
15. DOE G 420.1-1A, Nonreactor Nuclear Safety Design Guide for Use with DOE O 420.1C, Facility Safety, December 2012
16. DOE G 421.1-2A, *Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830*, December 2011
17. DOE G 423.1-1A, *Implementation Guide for Use in Developing Technical Safety Requirements*, November 2010
18. DOE G 424.1-1B, Chg 2, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, June 2013
19. DOE G 430.1-2, *Implementation Guide for Surveillance and Maintenance during Facility Transition and Disposition*, September 1999
20. DOE G 430.1-3, *Deactivation Implementation Guide*, September 1999
21. DOE G 430.1-4, *Decommissioning Implementation Guide*, September 1999
22. DOE G 430.1-5, *Transition Implementation Guide*, April 2001

23. DOE-STD-1020-2012, *Natural Phenomena Hazard Analysis and Design Criteria for Department of Energy Facilities*, December 2012
24. 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
25. DOE-STD-1066, *Fire Protection*, December 2012
26. DOE-STD-1073, *Configuration Management*, October 2003
27. DOE-STD-1104, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*, May 2009[3]
28. DOE-STD-1120, *Integration of Environment, Safety, and Health into Facility Disposition Activities*, April 2005
29. DOE-STD-1186, *Specific Administrative Controls*, March 2004
30. DOE-STD-1189, *Integration of Safety into the Design Process*, March 2008
31. DOE-STD-3007, *Guidelines for Preparing Criticality Safety Evaluation at the Department of Energy Non-reactor Nuclear Facilities*, February 2007
32. DOE-STD-3009, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, Change Notice 3, March 2006[4]
33. DOE-STD-5506, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*, May 2007

[3] 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.
[4] 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[5] for Review of DOE Field Office Safety Basis Program

LOIs	*Yes*	*No*
Safety Basis Policies and Procedures		
Has the Field Office established and communicated clear performance expectations, goals and strategies for safety basis activities that meet 10 CFR Part 830 Subpart B, DOE Directives and DOE Technical Standards?		
Do the Field Office's contract performance fee plans address quality, completeness, and timeliness aspects of safety basis development activities?		
Has the Field Office used this process to hold the contractors accountable for poor performance?		
Has the Field Office incorporated 10 CFR Part 830 requirements, DOE Headquarters' Directives and Technical Standards into local directives and guidance?		
Has the Field Office developed procedures for reviewing and approving contractor safety basis documents?		
Safety Basis Implementation and Maintenance		
Has the DOE performed periodic and scheduled assessments of contractors' safety basis processes, implementation, and systems? Note: Appendix D of DOE G 423.1.1A describes approaches for performing independent implementation verification reviews (IVRs) of safety basis controls.		
Does the Field Office have established processes and procedures for verifying safety basis implementation following initial approval or updates to DSAs and TSRs?		
Is there evidence of DOE approval of contractor's USQ process within a SER? Has the DOE reviewed the contractor's USQ process for adequacy?		
Has DOE established expectations on timely closure of JCOs? Is this documented in the contractor's USQ procedures? Note: JCOs should not continue past a required annual DSA update unless the JCO was submitted within three months of the submittal date of the annual update in accordance to DOE G 424.1.1B.		
Safety Basis Approval Process		

[5] These LOIs are based on 10 CFR 830, DOE Directives, Technical Standards, and Best Management Practices (italicized). 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.

LOIs	*Yes*	*No*
Is a review plan defining the extent and details of the review process developed for each DSA and approved by the SBAA?		
Are SERs prepared for all facilities and activities exceeding Hazard Category 3 threshold quantities?		
Do the SERs meet the expectations of field office procedures and DOE-STD-1104?		
Are SERs prepared for facilities downgraded below Hazard Category 3 based on a final categorization?		
DOE Staff Qualification and Training		
Are DOE safety basis reviewers and managers qualified in accordance with the Technical Qualification Program as specified in DOE O 462.1?		
Do policies and procedures exist that describe personnel selection, training, and qualification requirements, including minimal applicable requirements for education, experience, and skill level?		
For each level of the safety basis organizations, are the training and qualification needs established, including requirements, interfaces, training methods, training responsibilities and duties?		
For the review of the safety basis, have all of the critical skill sets been identified and accounted for? Are there adequate numbers of qualified staff?		
Are critical training needs identified annually through organizational analyses and annual review of Individual Development Plans?		
Are training plans prepared and communicated in the overall budget?		
Is there evidence the DOE Field Office has provided safety basis training to managers, facility representatives, and safety basis reviewers?		
DOE Staffing		
Are safety basis training needs evaluated, prioritized, and communicated in annual budget submissions?		
Are safety basis resource needs consistent with priorities identified in training plans?		
Do safety basis personnel staffing needs reflect an adequate skill mix to accomplish safety basis guidance preparation, review, and approval?		
Is there sufficient number of qualified staff available to accomplish safety basis guidance preparation, review, and approval?		

Attachment 2 - LOIs[6] for Review of Contractor Safety Basis Program

LOIs	Yes	No
Safety Basis Development		
Does the contractor maintain an up-to-date listing of nuclear facilities subject to 10 CFR 830, Subpart B?		
Do these nuclear facilities have approved DSAs and TSRs? Also, are USQ procedures in place for these facilities?		
Does the contractor have an established performance record of producing high quality safety basis documents (e.g., limited DOE rejections of DSAs/TSRs, no significant outstanding DOE/DNFSB Assessment findings or issues, and limited SER Conditions of Approval)?		
Does the contractor have a process for tracking conditions of approval to closure (including any required compensatory measures), verifying satisfactory closure of the condition of approval, notifying DOE when a Condition of Approval has been satisfied, and managing any conditions of approval until they are closed?		
Safety Basis Implementation and Maintenance		
Does the contractor have established processes and procedures for verifying safety basis implementation following initial approval or updates to DSAs and TSRs?		
Is there a documented record (such as for the last 5 years) that the contractor has routinely met the annual DSA update requirements and that these documents have been reviewed and approved by DOE?		
Are there requirements in the contractor's USQ process for establishing JCOs?		
Is there any indication in the contractor's USQ procedures that JCOs will be closed in a timely matter within a year of approval? Is there evidence that JCOs have been closed within a year of their approval? Note: JCOs should not continue past a required annual DSA update unless the JCO was submitted within three months of the submittal date of the annual update in accordance to DOE G 424.1.1B		
Does the contractor have management and tracking systems in place for SER Conditions of Approval?		
Is there evidence that SER Conditions of Approval have been tracked and closed on time?		

[6] These LOIs are based on10 CFR 830, DOE Directives and Technical Standards, and Best Management Practices (italicized). 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.

LOIs	Yes	No
Has the contract award fee been reduced because of nuclear safety performance concerns?		
In cases where the contractor has been cited with PAAA violations, is there evidence of improvement in the contractor's performance?		
Contractor Staffing		
Are contractor's safety basis training needs evaluated, prioritized, and communicated in annual budget submissions?		
Are safety basis resource needs consistent with priorities identified in training plans?		
Do safety basis personnel staffing needs reflect an adequate skill mix to accomplish safety basis preparation, implementation and maintenance?		
Is there a sufficient number of qualified staff available to accomplish safety basis preparation, implementation and maintenance?		
Does the contractor incorporate 10 CFR 830, Subpart B, DOE Directives and Technical Standard requirements into facility/site procedures for safety basis programs and documentation?		
Training and Qualification[7]		
Are contractor's training plans, programs, and activities consistent with current safety basis requirements, facility hazards, facility disposition phases, and job responsibilities?		
Do safety analysts and USQ evaluators/reviewers meet training and qualification requirements?		
Have project and facility managers received safety basis training that provides management level overview of 10 CFR 830, Subpart B requirements?		
Self Assessment		
Are safety basis activities included in contractor assessment schedules (e.g., USQ process)?		
Is there evidence that safety basis assessments are performed, corrective actions identified and closed, and extent of condition and effectiveness reviews conducted as necessary?		

[7] Additional LOIs can be formulated from DOE O 426.2.