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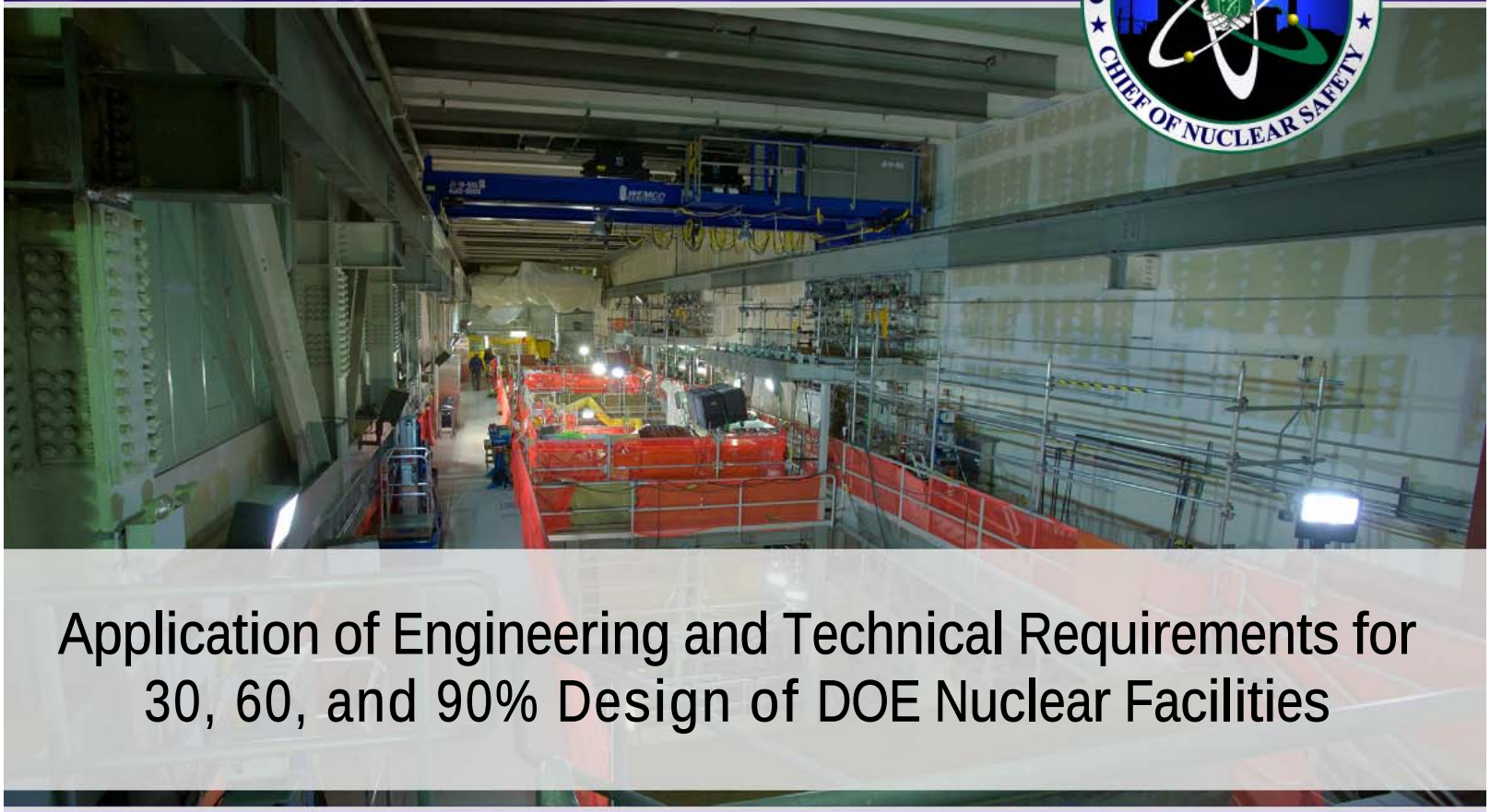

Application of Engineering and Technical Requirements for 30, 60, and 90% Design of DOE Nuclear Facilities

Standard Review Plan

October 2015

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Table of Contents

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Overview

This Standard Review Plan (SRP), *Application of Engineering and Technical Requirements for 30, 60 and 90% Design of DOE Nuclear Facilities*, was developed by the Office of Chief of Nuclear Safety (CNS), Office of the Environmental Management. The SRP is designed to help strengthen the technical rigor of line management oversight and federal monitoring of the design process of DOE nuclear facilities.

This SRP (hereafter refers to as the *Engineering SRP)* provides consistent performance-based review guidance and Lines of Inquiry (LOIs) to assure that engineering and technical requirements are appropriately applied for the design of DOE nuclear facilities.

The organization of this document is as follows:

- Section 1.0 presents a roadmap to:
    - Technical disciplines for the Design Review Team (listed in Table 1).
    - Design Review Topics (listed in Table 2)
    - LOIs relevant to each Discipline.
- Section 2.0 presents the expectations for design evolution at each design lifecycle phase; 30, 60, and 90% design.
    - The explicit expectations are provided for each design phase.
- Section 3.0 presents guidance on conduct of the design review. It provides the general principles for the formation, management, and performance of the design review team.
- Appendix A provides the LOIs to be followed by each element of the Design Review Team. The LOIs are identified as appropriate for the 30%, 60%, and 90% Design Review. These LOIs can be used to review the conceptual design (0% to 30%), as appropriate. If necessary, the Design Review Teams may modify or supplement these LOIs based on project-specific situations. These LOIs may be revised in the future to reflect changes in the DOE requirements, lessons learned, and additional insights from nuclear facility design, operations, and disposition.
- Appendix B provides the abbreviations and acronyms.

Additionally; there are several other SRPs developed by CNS which provide supplemental LOIs for use during the design review process. These include:

- SRP on *Safety Basis Program Review During Design*, Volume 2, February 2015
- SRP on *Safety Basis Program Review of TSRs, USQs and SERs*, Volume 5, February 2015
- SRP on *Code of Record*, May 2014

- SRP on *Safety Design Strategy*, November 2014
- SRP on *Conceptual Design Rev*iew, March 2010
- SRP on *Preliminary Design R*eview, March 2010
- SRP on *Final Design Review*, March 2010
- SRP on *Conceptual Safety Design*, March 2010
- SRP on *Preliminary Safety Design*, March 2010
- SRP on *Seismic Design Expectations*, March 2010
- SRP on *Quality Assurance*, March 2010

Please contact the appropriate subject matter expert (SME) within the Office of Chief of Nuclear Safety with any questions or request for technical assistance. Staff profile and contact information, as well as electronic copy of all SRPs can be found on CNS website: http://energy.gov/em/chief-nuclear-safety

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1.0 Engineering SRP Lines of Inquiry

The Lines of Inquiry (LOIs) are divided among 13 disciplines (Table 1), each assigned to a Design Review Team discipline. In addition, all teams have to address the common considerations of Configuration Management and Quality Assurance.

The LOIs are further divided into 25 SRP Sections (Table 2). The sections to be reviewed by each Design Review Team discipline are indicated in Table 3, with some of the multi-discipline sections reviewed by more than one discipline.

Table 1. Design Review Team Disciplines		
1. Process/Systems	2. Geotechnical/Site Characterization	3. Plant Layout
4. Civil Structural	5. Materials and Corrosion	6. Mechanical
7. 7. Electrical	8. Instrumentation and Controls	9. Environmental, safety and Health
10. Construction	11. Operation	12. Inspection and Maintenance
13. Security and Emergency Response	Common: Configuration Management and Quality Assurance	

Table 2. Design Review Topics (SRP LOI Sections)		
1. Nuclear	2. Siting Criteria	3. Natural Phenomena Hazards and Structural Engineering
4. Fire Protection	5. Criticality	6. Mechanical
7. Electrical	8. Instrumentation and Control	9. Radiation Protection
10. Chemical	11. Hazardous Materials	12. Sustainability
13. Human Factors	14. Security	15. Pressure Safety
16. Environmental Protection	17. Emergency Preparation	18. Technology Readiness Assessment
19. Waste Management	20. D&D Considerations	21. Systems Engineering
22. Configuration Management	23. Nuclear Maintenance Management Program	24. Plant Layout
25. Materials and Corrosion		

Table 3. LOI Sets by Discipline		
Discipline	SRP Section	LOI Set
1 - Process/Systems	Technology Readiness	18
	Systems Engineering	21
	Nuclear	2
	Criticality	5
	Chemical	10
	Environmental Protection	16
2 - Geotechnical/Site Characterization	Siting Criteria	1
	NPH and Structural Engineering	3
	Environmental Protection	16
3 - Plant Layout	Layout	24
	Radiation Protection	9
	Hazardous Materials	11
	Sustainability	12
	Waste Management	19
	Deactivation and Decommissioning	20
4 - Civil-structural	NPH and Structural Engineering	3
	Deactivation and Decommissioning	20
5 - Materials and Corrosion	Materials and Corrosion	25
6a - Mechanical - Equipment	Mechanical	6
	Pressure Safety	15
6b - Mechanical - Fire Protection	Fire protection	4
	Mechanical	6
6c - Mechanical - Ventilation-Confinement	Nuclear	2
	Mechanical	6
	Waste Management	19
7 - Electrical	Electrical	7
8 - Instrumentation and Controls	Instrumentation and Controls	8
	Criticality	5
9 - Environment, Safety and Health (ES&H)	Nuclear	2
	Criticality	5
	Chemical	10
	Radiation Protection	9
	Hazardous Materials	11

Table 3. LOI Sets by Discipline		
Discipline	SRP Section	LOI Set
	Human Factor	13
	Environmental Protection	16
	Emergency Preparedness	17
10 - Construction		
11 - Operations	Human Factor	13
	Radiation Protection	9
	Emergency Preparation	17
	Waste Management	19
12 - Inspections and Maintenance	Nuclear Maintenance Management	23
	Human Factor	13
13 - Security and Emergency Response	Safeguards and Security	14
	Emergency Preparation	17
All Disciplines	Configuration Management	22
	Systems Engineering	21
	Quality Assurance	TBD

2.0 Design Progress Expectations

For each discipline, the LOIs are identified as appropriate for the 30%, 60%, or 90% Design Review. These are based on the expectations listed in Table 4.

Table 4. Design Progress Expectations by Discipline

Discipline	Percent Design Review	Expectation What should be completed at each stage
1 – Process / Systems	**30%**	• *Basic chemical and nuclear process systems*: The process technology in the form of chemistries, nuclear criticality, process reactions, thermo-hydraulics of mixing or separation, feedstocks (in-coming materials), output (products), phase change, reaction physics, etc. should be completed and verified either by exact replication of a successful process (same processes, same sizes, same environments), or by testing. • *Support systems and utilities*: The design of support systems and utilities (cooling water, instrument air, steam supply, heat exchangers, etc.) need not be completed at this stage. • Alternative studies must have been completed so that there is no risk of change in technology in favor of a more efficient process. • The thermo-hydraulic designs (flows, equipment sizing) should be completed for the basic systems. • Safety classification, and defense-in-depth and single-failure design should be completed for the Basic chemical and nuclear systems, and the containment-confinement system.
	60%	• The design of support systems and utilities should be completed. • The P&IDs should be completed for all systems. • The line lists (pressures, temperatures, cycles) should be completed for all systems. • Safety classification, and defense-in-depth and single-failure design should be completed for all systems. • All products and chemicals should be identified for safe hazard protection. • Thermo-hydraulic design of utilities should be well underway.
	90%	• The design calculations, analyses, reports, specifications, drawings, should be completed, reviewed and approved, with no open items, so that they are ready for (a) turn-over to procurement, shop fabrication and field construction and installation, (b) finalization of pre-operational testing (commissioning), and (c) completion of operating procedures.

Table 4. Design Progress Expectations by Discipline		
Discipline	Percent Design Review	Expectation What should be completed at each stage
2 – Geotechnical / Site Characterization	**30%**	• Land-use of the facility, public exclusion zone, emergency response, etc. should have been approved. • Local geology, meteorology, hydrology studies should be completed satisfactorily. • The design-basis magnitude of natural phenomena hazards should have been established and finalized. • Seismicity should be completed in the form of hazards analysis and ground motions. • Human-induced hazards should have been identified. • Environmental impact studies and permits should be completed.
	60%	• No activity, should all have been resolved at 30%.
	90%	• No activity, should all have been resolved at 30%.
3 - Plant Layout	**30%**	• Layout plot plans of buildings and major structures should be completed, with verification that processes can be accommodated, including future expansions. • The 3D facility layout should have been reviewed and approved by all disciplines. • Civil-structural drawings of buildings and large structures should be completed, ready for design analysis and qualification.
	60%	• The 3D layout of distribution systems (piping, ducts, cable trays, etc.) and components (fans, compressors, etc.) should be completed, in accordance with the 60% design, all interferences resolved.
	90%	• Layout reflects final specifications and design of systems and components.
4 - Civil-Structural	**30%**	• The design and qualification codes, standards, criteria should be completed. • The design basis loads (normal, natural phenomena hazards, etc.) and safety and seismic classifications should have been defined. • The buildings models should have been started.
	60%	• The structural design analyses should be near completion. • The in-structure seismic response spectra should be final for the design of SSCs.
	90%	• The design calculations, analyses, reports, specifications, drawings, should be completed, reviewed and approved, with no open items, so that they are ready for turn-over to procurement, and field construction.
5 - Materials and Corrosion	**30%**	• The corrosion mechanisms should have been defined for each system and subsystem. • Materials options for the base processes should have been selected. • Material tests should have been planned for alloys and non-metallics for corrosive environments.

Table 4. Design Progress Expectations by Discipline		
Discipline	Percent Design Review	Expectation What should be completed at each stage
	60%	• Materials (base metal and weldments) tests should have been completed and materials selected and incorporated into project specifications. • Design lives and risk-informed inspections and replacement strategies should have been developed.
	90%	• Material selections and inspection-repair strategies should be final.
6a - Mechanical - Equipment	**30%**	• The codes, standards and design criteria for mechanical distribution systems (piping, tubing) and equipment (static: vessels, tanks; and active: pumps, valves, compressors) should be documented. • The design loads and environments should be in development. • The location of major mechanical equipment (reactors, process rooms, etc.) should be completed and provided to layout.
	60%	• The design loads and environments should be in development. • The design of 60% of the mechanical equipment should be completed, including 90% of the Basic chemical and nuclear equipment, in accordance with their safety classification. • The pressure safety strategy should be completed.
	90%	• The design calculations, analyses, reports, specifications, drawings, should be completed, reviewed and approved, with no open items, so that they are ready for turn-over to procurement, and field construction.
6b – Mech. - Fire Protection	**30%**	• The design and qualification codes, standards, criteria should be completed. • Site selection should have accounted for fire and emergency response capabilities on and off-site. • Internal and external fire sources should be completed. • The fire protection strategy (fire water source, fire loop, wet or dry system, standpipe, building distribution system, active and passive protection, fire walls and fire doors, etc.) should be completed. • The multi-layer strategy for safety-related fire protection should be completed, including defense in depth, and single failure. • The controls for the interface with the ventilation system should be completed. • The location of major fire protection equipment (water tanks, water main loop, etc.) should be completed and provided to layout.
	60%	• The layout and hydraulic sizing should be completed. • Fire safety and emergency response coordination should be completed. • The design of 60% of the mechanical equipment should be completed, including 90% of the fire protection for the Basic chemical and nuclear equipment, in accordance with the safety classification.

Table 4. Design Progress Expectations by Discipline		
Discipline	Percent Design Review	Expectation What should be completed at each stage
	90%	• The design calculations, analyses, reports, specifications, drawings, should be completed, reviewed and approved, with no open items, so that they are ready for turn-over to procurement, and field construction. • Procedures for alarms, evacuation, fire watches, and emergency response should be completed.
6c – Mech. - Ventilation-Confinement.	**30%**	• The design and qualification codes, standards, criteria should be completed. • The multi-layer strategy for containment (radiation and fluids) and confinement (particulate) should be completed, including active vs. passive, safety classification, defense in depth, and single failure. • The controls for the interface with the ventilation system should be completed. • The safety classification of the ventilation subsystems should be completed. • The location of major ventilation equipment (air handling units, intake and discharge plenums, stacks, etc.) should be completed and provided to layout.
	60%	• The layout and hydraulic sizing should be completed. • The design of 60% of the mechanical equipment should be completed, including 90% of the ventilation system for the Basic chemical and nuclear equipment, and the containment-confinement system in accordance with the safety classification.
	90%	• The design calculations, analyses, reports, specifications, drawings, should be completed, reviewed and approved, with no open items, so that they are ready for turn-over to procurement, and field construction.
7 - Electrical	**30%**	• The design and qualification codes, standards, criteria should be completed. • The normal power supplies and emergency power supplies should be defined to prevent black-out. • The multi-layer strategy for safety-related electrical systems should be completed, including defense in depth, and single failure. • The location of major electrical equipment (substations, switchgear, motor control center room, etc.) should be completed and provided to layout.
	60%	• The electrical design diagrams should be completed. • The design of 60% of the electrical equipment should be completed, in accordance with the safety classification.
	90%	• The design calculations, analyses, reports, specifications, drawings, should be completed, reviewed and approved, with no open items, so that they are ready for turn-over to procurement, and field construction.

Table 4. Design Progress Expectations by Discipline		
Discipline	Percent Design Review	Expectation What should be completed at each stage
8 – Instrumentation and Controls (I&C)	**30%**	• The design and qualification codes, standards, criteria should be completed. • The safety classification of I&C systems should be completed, including compliance to safety instrumentation levels criteria. • The multi-layer strategy for safety-related I&C systems should be completed, including defense in depth, and single failure.
	60%	• The I&C design and P&ID diagrams should be completed. • The design of 60% of the I&C equipment should be completed, including 90% of the I&C for the Basic chemical and nuclear equipment, in accordance with the safety classification; with a good interface with operations and human factor engineering.
	90%	• The design calculations, analyses, reports, specifications, drawings, should be completed, reviewed and approved, with no open items, so that they are ready for turn-over to procurement, and field construction.
9 - ES&H	**30%**	• The safety analysis codes, standards, criteria should be completed. • The portion of the safety analyses leading to the safety classification of the Basic chemical and nuclear systems and the containment-confinement systems should be completed, accounting for nuclear, criticality, chemical, and environmental effects.
	60%	• The detailed safety analyses for safety classification at the component level should be on-going for all structures, systems and components.
	90%	• The safety analyses should be completed, reviewed and approved, with no open items.
10 - Construction	**30%**	• Construction should have reviewed and approved the layout plans, excavation plans, foundation plans, and the location of major buildings and equipment. • Construction should have approved the design codes and standards for building structures and major equipment for construction feasibility and qualifications of construction personnel and contractors.
	60%	• Construction should have reviewed and approved the 60% layout and drawings for constructability.
	90%	• Construction should have reviewed and approved the 90% layout and drawings for constructability.
11 - Operations	**30%**	• Operations should have reviewed and approved the 30% design of the process/system design, the plant layout, the I&C design, and the emergency preparedness.
	60%	• Operations should have reviewed and approved the 60% design of the process/system design, the plant layout, the I&C design, and the emergency preparedness.

Table 4. Design Progress Expectations by Discipline		
Discipline	Percent Design Review	Expectation What should be completed at each stage
	90%	• Operations should have reviewed and approved the 90% design of the process/system design, the plant layout, the I&C design, and the emergency preparedness.
12 - Inspections and Maint.	**30%**	• Inspection and maintenance should have reviewed and approved the 30% design of the materials, mechanical, electrical, and I&C disciplines, for the feasibility of access for inspections, tests, and repair-replacements.
	60%	• Inspection and maintenance should have reviewed and approved the 30% design of the materials, mechanical, electrical, and I&C disciplines, for the feasibility of access for inspections, tests, and repair-replacements.
	90%	• Inspection and maintenance should have reviewed and approved the 30% design of the materials, mechanical, electrical, and I&C disciplines, for the feasibility of access for inspections, tests, and repair-replacements.
13 - Security and Emergency Response	**30%**	TBD
	60%	TBD
	90%	TBD
Configuration Mgt. and QA	**30%**	TBD
	60%	TBD
	90%	TBD

3.0 Conduct of the Design Review Process

At each stage (30%, 60%, 90%), the Design Review process should be conducted within the following general principles:

1. The Design Review Team (DRT) should have a chair, a vice-chair, and a secretary.

2. The scope of the Design Review should be stated in terms of:
    a. The percentage (30%, 60%, or 90%) stage of the review.
    b. The physical boundaries of scope to be reviewed (facility, buildings, units, systems, sub-systems, etc.) including building drawings, flow diagrams, P&IDs, electrical diagrams, and ventilation diagrams, indicating scope of the design review.
    c. Which of the 13 disciplines in Table 3 will be involved in the Design Review.

3. The DRT should be comprised of a minimum of two subject matter experts (SMEs) in each of the 13 disciplines identified in Table 1, unless the discipline is excluded from a particular review for reasons agreed-upon by the Design Review chair and DOE. Additional DRT members who are not assigned as SMEs for one of the 13 disciplines should only be assigned with the chair's and DOE's approval.

4. The Engineering Design Team (EDT) should have a chair and vice-chair, and should provide the list of the discipline SMEs to the DRT chair to communicate to their DRT counterparts.

5. The EDT should provide to the DRT a design plan indicating the overall design strategy, the project-specific design standards, and the design schedule with the list of design activities with their progress status, and the list of completed and in-progress design documents, by discipline.

6. The EDT should provide the design documents to be reviewed in advance, with sufficient time for the DRT to review the documents prior to the Design Review meeting.

7. The Design Review kick-off meeting would start with a common multi-discipline presentation by the EDT to cover, as a minimum, scope and agenda of the review, design documents to be reviewed, and the design status (work completed, work in progress, work not initiated).

8. At the kick-off meeting the DRT chair would outline expectations, Design Review charter, operating procedures, and documentation of the proceedings, submittal of DRT requests for information, responses by the EDT, and acceptance by the DRT.

9. The kick-off would be followed by break-out sessions by discipline.

10. The DRT should structure its review along the LOIs in Appendix A, plus other project-specific questions, at the discretion of the DRT SMEs.

11. Each DRT discipline review should track their questions, responses, additional requests for information, and open items, and provide them to the DRT secretary.

12. The Design review would conclude with a common multi-discipline meeting in which each discipline would report their conclusions, open items, and path forward.

13. The DRT secretary would compile the DRT reports by discipline and the requests for information.

14. Where there are differences of opinions among the DRT, or between the DRT and the EDT, the DRT chair will work to resolve them and achieve consensus.

15. The DRT report would be circulated to the DRT and the EDT for review and comments before formal issue.

16. Once the EDT has responded to all requests for information to the satisfaction of the DRT, the final Design Review report is prepared by the Secretary, reviewed by the DRT, and signed by the DRT chair.

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Appendix A Lines of Inquiry (LOI) for Engineering Review

This appendix contains 25 sets of LOIs[1] developed for engineering review. Additional engineering and technical areas can be added in the future based on lessons learned from onsite reviews. The following table provides a brief description of the LOIs and it is followed by the detailed LOIs for the subject areas.

Lines of Inquiry (LOI) sets.		
LOI Set	Subject	Description
1	Siting Criteria	This set of LOIs provides for the review of the nuclear siting criteria for new facility siting and design.
2	Nuclear	This set of LOIs provides for the review of the nuclear design criteria to ensure that DOE hazard category 1, 2, and 3 nuclear facilities are designed, constructed, operated, and dispositioned in a manner that ensures adequate protection to the public, workers, and the environment from nuclear hazards. Additional nuclear safety basis LOIs are contained in the *SRP Nuclear Safety Basis Program Review Module.*
3	Natural Phenomena Hazards and Structural Engineering	This set of LOIs provides for the review of the natural phenomena hazards (NPHs) and related structural engineering and safety criteria. The NPHs include seismic, wind, fire, flood, and other external events.
4	Fire Protection	This set of LOIs provides for the review of the fire protection programs and fire safety design of DOE nuclear facilities. The set applies for the entire facility life cycle.
5	Criticality	This set of LOIs provides for the review of the criticality safety design and operational programs for nuclear facilities and activities to ensure adequate protection to the public, workers, and the environment. The set applies for the entire facility life cycle.
6	Mechanical	This set of LOIs provides for the review of the design and operations of mechanical equipment classified as safety significant or safety class which provide both passive and active safety functions. The mechanical equipment includes confinement ventilation and HEPA filters of nuclear facilities.
7	Electrical	This set of LOIs provides for the review of the electrical design and electrical safety programs to provide power to systems and components that require electrical power in order to perform their safety functions, and to provide a sound and effective approach to electrical safety to ensure the safety of facility workers.
8	Instrument and Control	This set of LOIs provides for the review of the design, procurement, installation, testing, maintenance, operation, and quality assurance of safety instrumented systems (SIS) that are used at DOE nuclear facilities.

[1] The acronyms contained in the LOIs are defined in Appendix C.

Lines of Inquiry (LOI) sets.		
LOI Set	Subject	Description
9	Radiation Protection	This set of LOIs provides for the review of the radiological protection design and program to minimize personnel external and internal exposures to radioactive materials; provide adequate radiation posting, sampling, monitoring, and notification or alarm capabilities; and apply ALARA principles. Radiation protection should be provided through facility physical design and a program must be implemented for facility operation and disposition.
10	Chemical	This set of LOIs provides for the review of the chemical hazards during the design process and the review of the chemical management program for operations and disposition activities.
11	Hazardous Materials	This set of LOIs provides for the review of the design and implementation hazardous materials programs (radioactive materials and chemicals) to minimize the risk to the worker, public and environment. These LOIs apply to the entire facility life cycle.
12	Sustainability	This set of LOIs provides for the review of the high performance and sustainable building principles applicable to the siting, design, construction, and commissioning of new facilities and major renovations of existing facilities.
13	Human Factors	This set of LOIs provides for the review of the human factors engineering and criteria applicable to the design, operation, and maintenance of DOE nuclear facilities. This set applies to the entire facility life cycle.
14	Security	This set of LOIs provides for the review of the safeguards and security review based on the requirements and guidance of DOE O 413.3B, DOE G 413.3-3, DOE 470 series directives for safeguards and security, and 205 series of DOE directives for cyber security. This set applies to the entire facility life cycle.
15	Pressure Safety	This set of LOIs provides for the review of the pressure safety design and programs in support of worker safety and facility safety. Commercial standards such as ASME Boiler and Pressure Vessel codes are invoked by DOE regulations and directives for the design of process equipment with pressure safety significance. This set applies to the entire facility life cycle.
16	Environmental Protection	This set of LOIs provides for the review of the application of the DOE National Environmental Policy Act (NEPA) process during nuclear facility design phases and the development and implementation of the Environment Environmental Management System prior to operations, and during facility operations and disposition, and environmental restoration.
17	Emergency Preparation	This set of LOIs provides for the review of the Emergency Management System which provides the framework for the development, coordination, control, and direction of all emergency planning, preparedness, readiness assurance, response, and recovery actions. This set applies to the entire facility life cycle.
18	Technology Readiness Assessment	This set of LOIs provides for the review of the Technology Readiness Assessments (TRAs) and the development of the Technology Maturation Plans (TMPs) during DOE nuclear facility design. The TRAs and TMPs activities are tools to assist in identifying technology risks and enable the correct quantification of scope, cost and schedule impacts in the project.

Lines of Inquiry (LOI) sets.		
LOI Set	Subject	Description
19	Waste Management	This set of LOIs provides for the review of the design and operation of waste management systems in a manner that is protective of worker and public safety and the environment.
20	D&D Considerations	This set of LOIs provides for the review of the nuclear facility design to facilitate ultimate deactivation, decontamination, and decommissioning.
21	Systems Engineering	This set of LOIs provides for the review of the systems engineering during facility design and construction and the implementation of the System Engineer Program for nuclear facility operations and maintenance.
22	Configuration Management	This set of LOIs provides for the review of the configuration management program to assure that it: 1) has been established and documented; and 2) is being effectively implemented to ensure the adequacy of the structures, systems and components (SSCs) and documentation relied upon for the protection of the public, workers and environment.
23	Nuclear Maintenance Management Program	This set of LOIs provides for the review of nuclear maintenance management programs of the entire life cycle of the DOE nuclear facilities. DOE O 433.1B defines the safety management program for maintenance and the reliable performance of structures, systems and components (SSCs) and DOE O 430.1B provides maintenance program requirements from the perspective of real property management.
24	Plant Layout	This set of LOIs provides for the review of the plot plan and plant layout drawings, location and size of major buildings, verification of their capacity to accommodate the process and supporting systems, and layout of major equipment, and arrangements for principal and supporting structures, systems, and components, while providing for safe protection of the control rooms, and access for inspections and maintenance.
25	Materials and Corrosion	This set of LOIs provides for the review of the material selections and corrosion control for each structure, system and subsystem, equipment, and component to sustain the operating and design conditions for the design life of the SSC.

LOI Set 1: Siting Criteria[2]

LOI Set 1: Siting Criteria				
Criterion	Siting Criteria Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1 (30%)	Have the site boundary and land-use of the site surroundings been considered in determining facility site suitability and in establishing the facility safety design criteria? **Note:** This includes properties at risk from accidental exposures, public exclusion zones, population centers distances, and population density.	X		DOE G 420.1-1[3] Section 3.2
2 (30%)	Has the proximity of fire departments and emergency medical centers been considered in determining facility site suitability and in establishing the facility safety design criteria?	X		DOE G 420.1-1 Section 3.2
3 (30%)	Have the utility systems essential to support safety class structures, systems and components been considered in determining facility site suitability and in establishing the facility safety design criteria?	X		DOE G 420.1-1 Section 3.2
4 (30%)	Have the physical characteristics of the site, including topography, meteorology, and hydrology, been considered in determining facility site suitability and in establishing the facility safety design criteria?	X		DOE G 420.1-1 Section 3.2

[2] DOE G 420.1-1 specifies that radiological siting criteria of 25 rem, 50-year effective dose equivalent must be used, from releases over the course of postulated design basis accidents from uptakes at the site boundary that could be delivered during a one year period.

[3] DOE-STD-1189 (Appendix I) references DOE G 420.1-1 on the evaluation of siting criteria in preparation of the preliminary and final design stage of safety documentation.

LOI Set 1: Siting Criteria				
Criterion	Siting Criteria Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
5 (30%)	Have the geological and subsurface elements such as earthquake loading, soil bearing design capacity, rock or other bearing stratum, and groundwater elevations been considered in determining facility site suitability and in establishing the facility safety design criteria?	X		DOE G 420.1-1 Section 3.2
6 (30%)	Have the natural phenomena hazards, including seismic activity, wind, hurricane, tornado, flood, hail, volcanic ash, lightning, and snow, been considered in determining facility site suitability and in establishing the facility safety design criteria?	X		DOE G 420.1-1 Section 3.2
7 (30%)	Have emergency response considerations, including population sheltering or shielding parameters, evacuation delay times, and rates for the public and co-located workers been considered in determining facility site suitability and in establishing the facility safety design criteria?	X		DOE G 420.1-1 Section 3.2
8 (30%)	Have potential human-induced hazards from nearby facilities or activities such as industrial and military facilities, aircraft impacts, pipelines, and transportation routes been considered in determining facility site suitability and in establishing the facility safety design criteria?	X		DOE G 420.1-1 Section 3.2
9 (30%)	Have the proximity and hazard to other nearby facilities been considered in determining facility site suitability and in establishing the facility safety design criteria?	X		DOE G 420.1-1 Section 3.2
10 (30%)	Have site-related assumptions for the Environmental Impact Statement (EIS) been considered in determining facility site suitability and in establishing the facility safety design criteria?	X		DOE G 420.1-1 Section 3.2

LOI Set 1: Siting Criteria				
Criterion	Siting Criteria Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
11 (30%)	Are the facility fence and exclusion areas well mapped and defined?	X		Best Engineering Practice (BEP)
12 (30%)	Are there hazardous chemicals, fire or explosive materials stored on-site or nearby?	X		BEP
13 (30%)	Is the site meteorology characterized, including local climatology, precipitations, thunderstorms, lightning, wind speeds and directions (plume dispersion), tornado potential, droughts (loss of cooling source), hail, ice and snow, temperature and humidity (for the design of the HVAC systems)?	X		BEP
14 (30%)	Is the site hydrology characterized, including probable maximum flood on streams and rivers, potential dam failures, probable maximum surge and seiche flooding, probable maximum tsunami hazards, ice and snow effects, low water considerations, groundwater?	X		BEP
15 (30%)	Is the geological, seismological, and geotechnical engineering characterization of the site completed?	X		BEP
16 (30%)	Are the site soil properties and layering characteristics defined?	X		BEP
17 (30%)	Are ground faulting and seismic features characterized?	X		BEP
18 (30%)	Has the natural and seismic stability of subsurface materials, foundations, and slopes characterized?	X		BEP
19 (30%)	Is the seismic hazard analysis completed and peer reviewed (source terms, attenuation functions), in order to develop the seismic ground motions?	X		BEP

LOI Set 1: Siting Criteria				
Criterion	Siting Criteria Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
20 (30%)	Is the control room located and designed to sustain without damage the design-basis internal or external accidents?	X		BEP

LOI Set 2: Nuclear[4]

LOI Set 2: Nuclear				
	Nuclear Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
Nuclear Facility Design				
1	Do the nuclear facility design objectives follow the principles of defense-in-depth (DID)? **Note:** DID principles involve multiple layers of protection to prevent or mitigate the unintended release of radioactive materials to the environment. Conceptually there are three levels of DID. These multiple layers must include multiple physical barriers unless the basis for not including multiple physical barriers is documented in the documented safety analysis (DSA) and approved by DOE. DOE approvals are made by the Safety Basis Approval Authority, Federal Project Director, and/or the Design Authority.	X		DOE O 420.1B, Chg 1, Chapter I, Section 3.b (1) DOE G 420.1-1, Chapter 2, Section 2.3
2	Are the DID principles applied to the design include the following? • choosing an appropriate site • minimizing the quantity of material at risk • applying conservative design margins and quality assurance • using successive physical barriers for protection against radioactive releases • using multiple means to ensure critical safety functions needed to 1) control processes, 2) maintain processes in safe status, and 3) confine and mitigate the potential for accidents with radiological releases • using equipment and administrative controls that 1) restrict deviation for normal operations, 2) monitor facility conditions during and after an event, and 3) provide response to accidents to achieve a safety conditions • providing means to monitor accident releases as required for emergency response • establishing emergency plans for minimizing the effects of an accident	X		DOE O 420.1B, Chg 1, Chapter I, Section 3.b (2) DOE G 420.1-1, Chapter 2, Section 2.3
3	Is the nuclear facility sited, designed, and constructed in a manner that ensures adequate	X		DOE O 420.1B, Chg 1, Chapter I, Section 3.b

[4] The LOIs related to the development and implementation of the nuclear safety basis programs are in the *SRP on application of safety basis requirements,*, which covers design, operations, disposition, and environmental restoration.

LOI Set 2: Nuclear				
	Nuclear Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	protection of the health and safety of the public, workers, and the environment from the effects of accidents involving radioactive materials release?			(3) DOE G 420.1-1, Chapters 2 through 5
4	Are confinement design considerations included in the design? **Note:** Nuclear facilities with uncontained radioactive material (as opposed to material determined by safety analysis to be adequately contained within drums, grout, or vitrified materials) must have the means to confine the uncontained radioactive materials to minimize their potential release in facility effluents during normal operations, accidents, and after accidents.	X		DOE O 420.1B, Chg 1, Chapter I, Section 3.b (4) DOE G 420.1-1, Chapters 2 through 5 DOE-HDBK-1132-99, Sections 1.1 and 1.2
5	Does the confinement design address the following? • for a specific nuclear facility, the number, arrangement, and characteristics of confinement barriers as determined on a case-by-case basis • consideration of the type, quantity, form, and conditions for dispersing the radioactive material in the confinement system design • use of engineering evaluations, tradeoffs, and experience to develop practical designs that achieve confinement system objectives • the adequacy of confinement systems to perform required functions as documented and accepted through the safety in design process as described in DOE-STD-1189	X		DOE O 420.1B, Chg 1, Chapter I, Section 3.b (4) DOE G 420.1-1, Chapters 2 through 5 DOE-HDBK-1132-99, Sections 1.1 and 1.2
6	Was the nuclear facility designed to: • facilitate safe deactivation, decommissioning, and decontamination at the end of facility life, including incorporation of design considerations during the operational period that facilitate future decontamination and decommissioning; • facilitate inspections, testing, maintenance, repair, and replacement of safety SSCs as part of a reliability, availability, and maintainability program with the objective that the facility is maintained in a safe state; and • keep occupational radiation exposures within statutory limits and as low as reasonably achievable (ALARA)?	X	X	DOE O 420.1B, Chg 1, Chapter I, Section 3.b (5) DOE G 420.1-1, Chapter 3, Section 3.7

LOI Set 2: Nuclear				
	Nuclear Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
7	Have the facility process systems designed to minimize waste production and mixing of radioactive and non-radioactive wastes?	X		DOE O 420.1B, Chg 1, Chapter I, Section 3.b (6) DOE G 420.1-1, Chapters 2 through 5
8	Have the safety structures, systems, and components (SSCs) and safety software been designed to perform their safety functions when called upon, and to meet the quality assurance program requirements of either 10 CFR 830, Subpart A, or DOE O 414.1D?	X		DOE O 420.1B, Chg 1, Chapter I, Section 3.b (7) DOE G 420.1-1, Chapters 5, Section 5.1.3
9	Are the safety class electrical systems designed to preclude single point failure?	X		DOE O 420.1B, Chg 1, Chapter I, Section 3.b (8) DOE G 420.1-1, Chapters 5, Section 5.2.3
Design Criteria for Safety Structures, Systems, and Components (SSCs)				
10	Are the safety SSCs and their associated support systems designed, fabricated, erected, and tested to standards and quality requirements commensurate with their importance to safety?	X		DOE G 420.1-1, Chapters 5, Section 5.1
11	Are the safety SSCs designed to perform their safety function under those conditions and events for which their safety function is intended?	X		DOE G 420.1-1, Chapters 5, Section 5.1.1
12	Have the following design principles been applied to the design of safety SSCs to most effectively enhance system availability and provide for robust design? • Conservative Design Features • Design Against Single-Point Failure • Environmental Qualification • Safe Failure Modes • Note: Further design guidance can be found in IAEA Standard No. 50-P-1 and ANSI/IEEE 603.	X		DOE G 420.1-1, Chapters 5, Section 5.1.1
13	Are support systems and interface design considered in the design process? **Note:** Safety SSCs often rely upon other SSCs to support their operation. Therefore, it is important to identify these support systems and the	X		DOE G 420.1-1, Chapters 5, Section 5.1.2

LOI Set 2: Nuclear				
	Nuclear Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	associated interfaces between safety and non-safety SSCs.			
14	Have the following support systems classification criteria been applied? • Support SSCs to safety-class SSCs must be classified as safety class if their failures can prevent a safety-class SSC from performing its safety functions. • Support SSCs to safety-significant SSCs that mitigate or prevent accidents with the potential for significant onsite consequences should be classified as safety-significant if their failures prevent a safety-significant SSC from performing its safety functions. • Support SSCs to safety-significant SSCs that mitigate or prevent accidents with the potential for significant localized consequences need not be classified as safety significant.	X		DOE G 420.1-1, Chapters 5, Section 5.1.2.1
15	Have system interfaces been evaluated to identify SSC failures that would prevent the safety SSCs from performing their intended safety function?	X		DOE G 420.1-1, Chapters 5, Section 5.1.2.2
16	Have the QA requirements been identified for the design, fabrication, construction, and modification of the safety SSCs?	X		DOE G 420.1-1, Chapters 5, Section 5.1.3
17	Have the design criteria from the national codes and standards been identified and tailored to specific applications based on the required safety function? **Note:** The design criteria selection is made by the Design Authority and should be documented in the engineering/design documents and in the Code of Record.	X		DOE G 420.1-1, Chapters 5, Section 5.2
18	Have the specific design criteria for safety SSCs been identified for engineering and design disciplines, including the following? • Structural • Mechanical, including ventilation, process equipment, mechanical handling equipment • Electrical • Instrumentation, controls, and alarm systems **Note:** Specific design criteria for safety SSCs often relate to a confinement function. Generally, three confinement systems are used to achieve the complete confinement system objective. The	X		DOE G 420.1-1, Chapters 5, Sections 5.2.1, 5.2.2, 5.2.3, and 5.2.4

LOI Set 2: Nuclear				
	Nuclear Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	terms confinement and confinement barriers are used in the context of the three types of confinement: primary, secondary, and tertiary.			
Integration of Design with Safety[5]				
19	During the preliminary design phase, did the DOE approve the nuclear safety design criteria for the preparing of the preliminary documented safety analysis (PDSA) (unless the contractor uses the design criteria in DOE O 420.1B)? **Note:** This is applicable if the construction begins after December 11, 2000 for new or major modification of DOE nuclear facilities.	X		10 CFR 830, Subpart B, §830.206
20	Are the nuclear safety analyses used to establish: 1) the identity and functions of safety class and safety significant structures, systems, and components (SSCs); and 2) the significance to safety of functions performed by safety class and safety significant SSCs?	X	X	DOE O 420.1B, Chg 1, Chapter I, Section 3.a (1)
21	Do the safety analyses address: 1) hazards inherent to the facility and its activities; 2) natural phenomena hazards; 3) external man-induced hazards, (factors such as proximity to airports, pipelines, hazardous traffic on roads or waterways, and adjacent facilities)?	X	X	DOE O 420.1B, Chg 1, Chapter I, Section 3.a (2)
22	Is safety integrated into the design early and throughout the design process consistent with DOE–STD-1189?	X	X	DOE O 420.1B, Chg 1, Chapter I, Section 3.a (3)
23	Are the following safety design guiding principles being applied for the design or major modification of a nuclear facility? • DOE Order 420.1B, *Facility Safety*, is utilized and addressed in design activities, as applicable. Design teams should be able to clearly articulate strategies in the design that address DOE O 420.1B expectations and include them in the design/safety basis information. • Control selection strategy to address hazardous material release events is based on the following order of preference at all stages of design development.	X		DOE STD-1189-2008 See also the LOIs in the *SRP Safety Basis Program Review Module*

[5] Additional LOIs on nuclear safety basis reviews are documented in the SRP on application of safety basis requirements and in the SRP on application of DOE O 413.3B and DOE-STD-1189- 2008 requirements.

LOI Set 2: Nuclear				
	Nuclear Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Minimization of hazardous materials is the first priority. • Safety structures, systems, and components (SSCs) are preferred over Administrative Controls. • Passive SSCs are preferred over active SSCs. • Preventative controls are preferred over mitigative controls. • Facility safety SSCs are preferred over personal protective equipment. • Controls closest to the hazard may provide protection to the largest population of potential receptors, including workers and the public. • Controls that are effective for multiple hazards can be resource-effective. • Design codes and standards incorporated into the DOE O 420.1B guides are to be followed, unless specific exceptions are taken to those listed and approved by DOE. **Note:** DOE-STD-1189 is silent on who are the DOE approval authorities. But they can include the FPD, DA, and/or the SBAA. The risk and opportunity assessment includes consideration of the Safety-in-Design approaches selected to address project cost contingencies and appropriate mitigation strategies for the risks/opportunities identified for the strategies selected. Early project decisions on a technical approach are conservative in order to establish appropriate cost and schedule baselines for the project. The CD packages portray safety-item selections, bases, and risks and opportunities, with proposed mitigation strategies and cost and contingencies, to enable informed risk decision-making by the project approval authorities regarding the project technical basis and cost. The project team includes appropriate expertise and is established early in the project cycle. Safety personnel are used from the onset of project planning to help ensure that appropriate hazards and techniques for hazard management are considered (e.g., material-at-risk [MAR] limitation, prevention techniques, and operationally effective design solutions).			

LOI Set 2: Nuclear				
	Nuclear Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	Important safety functions, such as facility building confinement, confinement ventilation approach and systems, fire protection strategies and systems, security requirements, life safety considerations, emergency power systems, and associated seismic design bases are addressed during conceptual design. The safety design team ensures sufficient process definition is available, particularly at the conceptual and preliminary design stages, to enable major safety cost drivers to be included in the design documentation, along with their associated safety functions and design criteria. The team also identifies the risks and opportunities associated with the selections identified and develops mitigation strategies that are included in the cost-estimate contingencies. Details may not be available in early project stages to identify all hazards and needed hazard controls. All stakeholders are important to the process. Stakeholder issues are identified early and addressed. To ensure that the project/facility configuration can be managed appropriately, the basis for decisions related to safety is clearly documented.			

LOI Set 3: Natural Phenomena Hazards and Structural Engineering[6]

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Has the facility or operations been analyzed to ensure that SSCs and personnel will be able to perform their intended safety functions effectively under the effects of NPH? **Note:** Where no specific requirements are identified, model building codes or national consensus industry standards must be used consistent with the intended SSC functions.	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3
2	Have the facility SSCs been designed, constructed, and operated to withstand NPH and ensure: (a) confinement of hazardous materials; (b) protection of occupants of the facility, as well as members of the public; (c) continued operation of essential facilities; and (d) protection of government property.	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (a) (1)
3	Does the design/construction of new facility (new and major modifications to existing facilities) and SSCs address— (a) potential damage to and failure of SSCs resulting from both direct and indirect NPH events; (b) common cause/effect and interactions resulting from failures of other SSCs; and (c) compliance with seismic requirements of EO 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction (as amended by EO 13286, Amendment of Executive Orders, and Other Actions, in Connection With the Transfer of Certain Functions to the Secretary of Homeland Security, January 5, 1990).	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (a) (2)
4	Are additions and modifications to existing DOE facilities designed and constructed such that they do not degrade SSC performance during an NPH occurrence?	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (a) (3)
5	Are SSCs in existing DOE facilities evaluated when there is a significant degradation in the facility safety basis? Do the evaluations address the safety significance	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (b) (1)

[6] Refer also to the SRP on Seismic Design Expectation for similar or additional LOIs developed to support project Critical Decision approvals. This report is contained in the 2nd Edition of the SRP on the application of DOE O 413.3B and DOE-STD-1189 requirements published in March 2010 .

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	of the SSCs and the seismic requirements of EO 12941, Seismic Safety of Existing Federally Owned or Leased Buildings?			
6	If the evaluation of existing SSCs identifies NPH mitigation deficiencies, is an upgrade plan implemented on a prioritized schedule based on the safety significance of the upgrades, time or funding constraints, and mission requirements?	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (b) (2)
7	Do both facility design and evaluation criteria address the potential types of NPH occurrences? Does the NPH assessment use a graded approach commensurate with the potential hazard of the facility?	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (c) (1)
8	Does the NPH assessment for new facilities use a graded approach that considers the consequences of all types of NPHs? Is site-wide information considered?	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (c) (2)
9	Are NPH assessments reviewed and upgraded as necessary for existing sites/facilities following significant changes in NPH assessment methodology or site-specific information?	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (c) (3)
10	Is an NPH assessment review conducted at least every 10 years and does it include recommendations to DOE for updating the existing assessments based on significant changes found in methods or data? **Note:** If no change is warranted from the earlier assessment, then this only needs to be documented.	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (c) (4)
11	Do the facilities or sites with hazardous materials have instrumentation or other means to detect and record the occurrence and severity of seismic events?	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (d)
12	Do facilities or sites with hazardous materials have procedures for inspecting facilities for damage from severe NPH events and placing a facility into a safe configuration when damage has occurred?	X	X	DOE O 420.1B Chg 1; Chapter IV, Section 3 (e)
13	Were the following factors considered in determining facility site suitability and in establishing facility safety design criteria: NPHs as discussed in Section 3.3, Natural Phenomena Hazards, of this Guide and DOE O 420.1, Section 4.4, Natural Phenomena Hazards Mitigation, including seismic activity, wind, hurricane, tornado, flood, hail, volcanic ash,	X		DOE G 420.1-1, Section 3.2

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	lightning, and snow?			
14	Were all safety SSCs designed and constructed to withstand the effects of natural phenomena hazards based on the fundamental requirements for NPHs as specified in the regional model building codes?	X		DOE G 420.1-1, Section 3.3
15	Were criteria for the assessment and mitigation of volcanic eruption and ash fall, lightning strikes, range fires, snow loads, and extreme temperatures hazards developed on a site-specific basis and approved by DOE prior to use?	X		DOE G 420.1-1, Section 3.3
16	Are lightning protection systems designed to comply with NFPA 780?	X		DOE G 420.1-1, Section 3.3
17	Did design development consider the interaction of more than one event, particularly those more likely to occur simultaneously?	X		DOE G 420.1-1, Section 3.3
18	Where shielding is an integral part of the facility structure, was it designed and installed to at least the same level of natural phenomenon qualification as the facility structure?	X		DOE G 420.1-1, Section 4.2.2
19	Does the design of safety-class SSCs incorporate suitably conservative criteria contained in applicable DOE Orders and Standards addressing safety functions (e.g., natural phenomena design mitigation)?	X		DOE G 420.1-1, Section 5.1.1.1
20	As part of the safety analysis, was a list that identifies the functions, performance, and natural phenomena design requirements and associated QA requirements of all safety-class SSCs prepared, and do procedures require that it be maintained for the life of the project through decommissioning?	X		DOE G 420.1-1, Section 5.1.3
21	Does the design comply with the requirements of the NEHRP, EO 12699 (1-5-90), and EO 12941 (12-1-94)?	X		DOE G 420.1-2, Section 4
22	Does the NPH design, evaluation, and construction for NPH mitigation ensure the DOE goals are met: (1) providing for safe work places; (2) protecting against property loss or damage; (3) continued operation of essential facilities; and (4) protecting public health, property, and the environment against exposure to hazardous materials?	X		DOE G 420.1-2, Section 5
23	Have all SSCs been designed, constructed and are they being operated to withstand the effects of natural phenomena as necessary to ensure the	X	X	DOE G 420.1-2, Section 6.2.1

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	confinement of hazardous material, the operation of essential facilities (as per the definition of PC-2)?			
24	Does the design and evaluation process consider potential damage and failure of SSCs due to both direct natural phenomena effects (including common cause) and indirect natural phenomena effects due to the response of other SSCs (interaction)?	X	X	DOE G 420.1-2, Section 6.2.1
25	Does the design and evaluation consider common cause effects (e.g. failure of multiple tanks due to seismic events)?	X	X	DOE G 420.1-2, Section 6.2.1
26	Does the facility/site have SSCs in PC-2, PC-3, or PC-4? If so, does it have procedures to inspect the facility for damage due to a severe natural phenomena event, to place the facility into a safe configuration when damage occurs, and to document and report such damage?		X	DOE G 420.1-2, Section 6.6
27	Does the Contract or the Request for Proposals include an overview of the NPH design requirements for the facility?	X		Best Management Practice
28	Does the Contract or the Request for Proposals reference any applicable site NPH-related standards and/or NPH analysis standards?	X		Best Management Practice
29	Does the Contract or the Request for Proposals stipulate any required geotechnical investigations and engineering to be performed in support of facility design, while referencing any pertinent existing information such as geotechnical reports from nearby facilities, regional geotechnical data, etc.?	X		Best Management Practice
30	Does the Contract or the Request for Proposals define the expected peer reviews of geotechnical, structural, and seismic design, as well as the requirement for a Structural Summary Report?	X		Best Management Practice
31	(Conceptual Design): Are the control strategies for DBAs clearly identified in the hazards analysis, including the following: • required safety functions and classifications; • SSCs required to perform these functions; and • NPH performance categories (non- seismic NPH) and seismic design bases for major SSCs?	X		DOE-STD-1189-2008, Section 4.2
32	(Preliminary Design): Does the HA: • address the spectrum of accidents that may impact design and which may be initiated by	X		DOE-STD-1189-2008, Section 4.3

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	facility operations, natural phenomena, and external man-induced events; • evaluate potential accident consequences to the public and workers; and • identify and assess associated preventive and mitigation features, including classification (i.e., safety class, safety significant, and SACs based on the significance of possible consequences)?			
33	Does the CDR provide an integrated discussion of the key results of the hazards analysis including the following: • facility hazard category determination; • selected safety functions and controls; • SSC functional classifications, performance categories, and seismic design • criteria for NPH protection; • design criteria for the safety SSCs, and approach to be taken to further develop and document the safety basis through the remaining project phases?	X		DOE-STD-1189-2008, Section 6.1
34	Does the PDSR include relevant information regarding the natural phenomena for the site/ facility?	X		DOE-STD-1189-2008, Section 6.3
35	Does the PDSR include a summary of the HA, including process hazards evaluation, selected DBAs; FHA, selected safety SSCs and their safety function; functional classification; and required seismic and other natural phenomena design criteria, including their bases?	X		DOE-STD-1189-2008, Section 6.3
36	Does the design conform with the following criteria for selecting the SDC: • DOE implementation of ANS Standard 2.26 relies on conservative bases for unmitigated accident analysis; • A worker, in the ANS Standard 2.26, is interpreted to mean a collocated worker at a distance of 100 m from a facility (building perimeter) or estimated release point; • For criteria associated with the public, the methodology of assessment to be followed is that of Appendix C of DOE-STD-3009-94, CN 3; • Criteria doses are TEDE; • In conceptual design, if there are no bases for defining seismic related DBAs, HC-2 facility	X		DOE-STD-1189-2008, Section A-1.

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	structural designs must default to ANSI/ANS 2.26 SDC-3, Limit State D. If the hazards analysis conducted during subsequent stages of design shows that unmitigated consequences are less than the threshold criteria for SDC-3 shown in Table A-1 of STD-1189, then this may be reflected in the evolving design stages; and • Until ANS 2.27 and ANS 2.29, which are referenced in ANS 2.26, are formally issued by ANS and adopted by DOE, DOE Standards 1022 and 1023 should continue to be used in seismic design. **Note:** For other natural phenomena hazards (NPH), DOE Standards 1020, 1021, 1022, and 1023 are applicable.			
37	Does the analysis used to determine the SDC use, a χ/Q value at 100 m of 3.5E-3 sec/m3 for the dispersion calculation? This value is based upon NUREG 1140 (no buoyancy, F-stability, 1.0 m/sec wind speed at 100 m, small building size [10 m x 25 m], and 1 cm/sec deposition velocity)? Are dispersion analyses for public dose calculations done according to the guidance of DOE-STD-3009-94, CN 3, Appendix C?	X		DOE-STD-1189-2008, Section A-1.
38	Does the selection of SDC meet the supplemental guidance identified in DOE-STD-1189-2008, Section A.1?	X		DOE-STD-1189-2008, Section A-1.
39	Are evaluations of existing facilities and SSCs performed against the criteria identified in DOE-STD-1020-2002?		X	DOE-STD-1020-2002, Section 1.3
40	Does the QA plan for review of system design include (on the design drawings or evaluation calculations provided by the engineer) , the NPH design basis incorporating (1) the description of the system resisting NPH effects and (2) the definition of the NPH loading used for the design or evaluation?	X		DOE-STD-1020-2002, Section 1.4
41	If the PC of the system is PC-2, 3 or 4 does the independent review meet the following criteria: • The peer review is to be performed by independent, qualified personnel; • The peer reviewer must not have been involved in the original design or evaluation; • If the peer reviewer is from the same company/organization as the designer/evaluator,	X		DOE-STD-1020-2002, Section 1.4

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	he must not be part of the same program where he could be influenced by cost and schedule consideration; and • Individuals performing peer reviews must be degreed civil/mechanical engineers or qualified professionals in the field of review with 5 or more years of experience in NPH evaluation?			
42	For seismic evaluations is the seismic loading defined in terms of a site-specific design response spectrum (the Design/Evaluation Basis Earthquake, [DBE]) as required?	X	X	DOE-STD-1020-2002, Section 2.2
43	Are PC-2 and lower SSCs designed or evaluated using the approaches specified in IBC 2000 seismic provisions?	X	X	DOE-STD-1020-2002, Section 2.2
44	Are PC-3 or higher seismic evaluations performed by a dynamic analysis approach that includes the following? 1. The input to the SSC model be defined by either a design response spectrum, or a compatible time history input motion. 2. The important estimated natural frequencies of the SSC, or the peak of the design response spectrum used as input. Multi-mode effects must be considered. 3. The resulting seismic induced inertial forces, appropriately distributed, and a load path evaluation (see Section C.4.2) for structural adequacy must be performed.	X	X	DOE-STD-1020-2002, Section 2.2
45	Does the design consider the NEHRP provisions and ICSSC comparisons to ensure the use of the proper model building code in the design and evaluation?	X	X	DOE-STD-1020-2002, Section 2.2
46	Has an elastic response spectrum dynamic analysis been performed for PC-3 and PC-4 SSCs to evaluate the elastic seismic demand on the SSCs?	X	X	DOE-STD-1020-2002, Section 2.2
47	Does the seismic evaluation process meet the requirements as identified below? • Select Performance Categories of structure, system, or component based on DOE G 420.1-2 and DOE-STD-1021. • For sites with PC-3 or PC-4 SSCs, obtain or develop a seismic hazard curve and design response spectra in accordance with DOE-STD-1023 for all performance categories based on site characterization discussed in DOE-STD-1022.	X	X	DOE-STD-1020-2002, Section 2.2

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Establish design basis earthquake from P_H, mean seismic hazard curve, and median response spectra. • For sites with only PC-1 and PC-2 SSCs, and no site-specific seismic hazard curve, obtain seismic coefficients from model building codes which are based on national seismic hazard maps prepared by the United States Geological Survey. If available, site specific data can be used for these categories but with limitations imposed in the IBC 2000.			
48	Does the evaluation of PC-1 and PC-2 SSCs meet the following requirements/process? • Evaluate element forces for non-seismic loads, DNS, expected to be acting concurrently with an earthquake. • Evaluate element forces, DSI, for earthquake loads. • Static force method, where V is applied as a load distributed over the height of the structure for regular facilities, or dynamic force method for irregular facilities as described in the IBC 2000. In either case, the total base shear is given in the IBC 2000 where the parameters are evaluated as follows: • Use Seismic Use Group I for design of PC-1 SSCs • Use Seismic Use Group III for design of PC-2 SSCs which essentially results in a multiplier of 1.5 to forces for PC-1 **Note:** The seismic design categories per IBC 2000 must also be taken into consideration.	X	X	DOE-STD-1020-2002, Section 2.2
49	For PC 1 and 2 SSCs does the seismic design and evaluation meet the requirements of IBC 2000? If a recent site-specific seismic hazard assessment is available, it can be used subject to limitations imposed in the IBC 2000. For evaluation of SSCs using site specific hazard analysis, the design shall be based on 5% critical damping as recommended by the IBC 2000.	X	X	DOE-STD-1020-2002, Section 2.2
50	Did the PC-1 or -2 design/evaluation: • Combine responses from various loadings (D_{NS} and D_{SI}) to evaluate demand, D_{TI}, by code specified load combination rules (e.g., load factors for ultimate strength design or applicable	X	X	DOE-STD-1020-2002, Section 2.3.1

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	load factors for allowable stress design)? • Evaluate capacities of SSCs, C_C, from code ultimate values when strength design is used (e.g., IBC for reinforced concrete or LRFD for steel) or from allowable stress levels (with one-third increase) when allowable stress design is used? (Minimum specified or 95% non-exceedance in-situ population values statistically adjusted for sample size, for material strengths should be used for capacity estimation.) • Compare demand, D_{TI}, with capacity, C_C, for all SSCs. If D_{TI} is less than or equal to C_C, the facility satisfies the seismic force requirements. If D_{TI} is greater than C_C, the facility has inadequate seismic resistance? • Evaluate story drifts (i.e., the displacement of one level of the structure relative to the level above or below due to the design seismic forces), including both translation and torsion. Calculated story drifts should not exceed the limitations in IBC 2000? • Have elements of the facility checked to assure that all detailing requirements IBC 2000 provisions are met keeping into consideration the seismic design category of the building? • Utilize a quality assurance program consistent with model building code requirements shall be implemented for SSCs in Performance Categories 1 and 2. In addition, peer review shall be conducted for PC-2 SSCs?			
51	Are PC-3 and PC-4 SSCs evaluated per the following criteria: • Evaluate element forces, DNS, for the non-seismic loads expected to be acting concurrently with an earthquake. • Calculate the elastic seismic response to the DBE, D_s, using a dynamic analysis approach and appropriate damping values (per STD-1020 section 2.3.2) • Evaluate the total inelastic-factored demand D_{TI} as the sum of D_{SI} and D_{NS} (the best-estimate of all non-seismic demands expected to occur concurrently with the DBE). • Evaluate capacities of elements, C_C, from code ultimate or yield values • The seismic capacity is adequate when C_C	X	X	DOE-STD-1020-2002, Section 2.3.2

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	exceeds D_{TI} • Evaluate story drifts due to lateral forces, including both translation and torsion. • Check elements to assure that good detailing practice has been followed. • Implement peer review of engineering drawings and calculations (including proper application of F values) and require increased inspection and testing of new construction or existing facilities.			
52	Are damping values for PC-3 and PC-4 SSCs determined in accordance with section 2.3.3 of DOE-STD-1020-2002?	X	X	DOE-STD-1020-2002, Section 2.3.3
53	Is the design or evaluation of equipment or non-structural elements supported within a structure based on the total lateral seismic force, Fp, given by the IBC provisions for PC-1 and PC-2 systems?	X	X	DOE-STD-1020-2002, Section 2.4.1
54	For PC-2 equipment expected to remain functional during or after earthquake, was testing or experience based data for such equipment used as an additional qualification requirement?	X	X	DOE-STD-1020-2002, Section 2.4.1
55	For PC-3 and PC-4 systems and components, was the seismic design or evaluation based on dynamic analysis, testing, or past earthquake and testing experience data?	X	X	DOE-STD-1020-2002, Section 2.4.1
56	Are all PC-1 and PC- 2, parts of the structures, permanent nonstructural components, and equipment supported by a structure and their anchorages and required bracing designed to resist seismic forces as required by IBC?	X	X	DOE-STD-1020-2002, Section 2.4.1
57	For the analysis/evaluation were the lateral force determined using IBC 2000 distributed in proportion to the mass distribution of the element or component?	X	X	DOE-STD-1020-2002, Section 2.4.1
58	Were the forces determined used for the design or evaluation of elements or components and their connections and anchorage to the structure, and for members and connections that transfer the forces to the seismic-resisting systems? Were the forces applied in the horizontal direction that results in the most critical loadings for design/evaluation?	X	X	DOE-STD-1020-2002, Section 2.4.1
59	For PC-3 and PC-4 subsystems and components, were support excitation calculated by means of floor response spectra (also commonly called in-structure response spectra)?	X	X	DOE-STD-1020-2002, Section 2.4.1

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
60	Was the seismic anchor motion (SAM) component for seismic response obtained by conventional static analysis procedures or other approved techniques per DOE-STD-1020-2002?	X	X	DOE-STD-1020-2002, Section 2.4.1
61	If equipment adequacy is determined by testing is the testing performed in accordance with the guidance in DOE-STD-1020-2002, and the referenced industry standards?	X	X	DOE-STD-1020-2002, Section 2.4.1
62	If items are qualified by seismic experience data were the qualifications based on the industry standards as identified in DOE-STD-1020-2002?	X	X	DOE-STD-1020-2002, Section 2.4.1
63	Does the design/evaluation ensure adequate strength of equipment anchorage through consideration of tension, shear, and shear-tension interaction load conditions as discussed in SOE-STD-1020-2002 and the referenced industry standards?	X	X	DOE-STD-1020-2002, Section 2.4.1
64	Are existing facilities evaluated in accordance with the general guidelines for the seismic evaluation of existing facilities in the National Institute of Standards and Technology documents as identified in DOE-STD-1020-2002?	X	X	DOE-STD-1020-2002, Section 2.4.2
65	If the evaluation of an existing facility shows that the facility does not meet the seismic evaluation criteria of DOE-STD-1020-2002, has a back-fit analysis been conducted?	X	X	DOE-STD-1020-2002, Section 2.4.2
66	Were wind design calculations for PC SSCs performed using the criteria identified in Tables 3-1 and 3-2 of DOE-STD-1020-2002?	X	X	DOE-STD-1020-2002, Section 3.2
67	For PC-1 and PC-2 performance goals were they developed and met by the use of model codes or national standards as required by DOE-STD-1020-2002?	X		DOE-STD-1020-2002, Section 3.1
68	Were PC-1 category buildings and SSCs designed/analyzed in accordance with section 3.2.1 of DOE-STD-1020-2002?	X		DOE-STD-1020-2002, Section 3.2.1
69	Were PC-2 category buildings and SSCs designed/analyzed in accordance with section 3.2.2 of DOE-STD-1020-2002?	X		DOE-STD-1020-2002, Section 3.2.2
70	Were PC-3 category buildings and SSCs designed/analyzed in accordance with section 3.2.3 of DOE-STD-1020-2002 and ASCE 7?	X		DOE-STD-1020-2002, Section 3.2.3
71	Were PC-4 category buildings and SSCs designed/analyzed in accordance with section 3.2.4	X		DOE-STD-1020-2002, Section

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	of DOE-STD-1020-2002?			3.2.4
72	Is the wind resistance of SSCs designed based on the seven principles identified below? (a) Provide a continuous and traceable load path from surface to foundation (b) Account for all viable loads and load combinations (c) Provide a redundant structure that can redistribute loads when one structural element is overloaded (d) Provide ductile elements and connections that can undergo deformations without sudden and catastrophic collapse (e) Provide missile resistant wall and roof elements (f) Anchor mechanical equipment on roofs to resist specified wind and missile loads (g) Minimize or eliminate the potential for windborne missiles	X		DOE-STD-1020-2002, Section 3.2.5
73	Are existing structures and/or SSCs evaluated using the criteria and processes identified in section 3.3 of DOE-STD-1020-2002?			DOE-STD-1020-2002, Section 3.3
74	Were flood design calculations for SSCs performed using the criteria identified in Tables 4-1 and 4-2 of DOE-STD-1020-2002?			DOE-STD-1020-2002, Section 4.1
75	Do PC-1 SSCs and buildings meet the analysis and design requirements of section 4.2.1 of DOE-STD-1020-2002?	X		DOE-STD-1020-2002, Section 4.2.1
76	Do PC-2 SSCs and buildings meet the analysis and design requirements of section 4.2.2 of DOE-STD-1020-2002?	X		DOE-STD-1020-2002, Section 4.2.2
77	Do PC-3 SSCs and buildings meet the analysis and design requirements of section 4.2.3 of DOE-STD-1020-2002?	X		DOE-STD-1020-2002, Section 4.2.3
78	Do PC-4 SSCs and buildings meet the analysis and design requirements of section 4.2.4 of DOE-STD-1020-2002?	X		DOE-STD-1020-2002, Section 4.2.4
79	Is flood design for SSCs below the design basis flood plain consistent with the requirements of section 4.3 of DOE-STD-1020-2002 and the appropriate sub sections based on the PC of the SSC?	X		DOE-STD-1020-2002, Section 4.2.4
80	For PC-1, where a structure cannot be constructed above the DBFL level, is the design acceptable by			DOE-STD-1020-2002, Section

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	the following criteria? Where a structure cannot be constructed above the DBFL level, an acceptable design can be achieved by: • Modifying the flood or providing flood protection for the site or for the specific structure, such that severe structural damage does not occur, and • Developing emergency procedures in order to provide adequate warning and evacuation capability to provide for the safety of building occupants.			4.2.5
81	Are the normal operating modes and loads defined for all structures?	X		BEP
82	Are the normal operating modes and loads defined for all mechanical SSCs (line lists of pressure, temperature, transients)?	X		BEP
83	Have the natural phenomena hazards (NPH) applicable to the project been defined? (seismic, wind, tornado winds and missiles, flood, drought, tsunami, lightning, external fire, ash fall, dust storm, extreme ambient cold, extreme ambient heat, extreme fog)	X		BEP
84	Are the load combinations for normal operation and for NPH and concurrent loads, defined?	X		BEP
85	Are the SSCs designed or protected from the effects of design winds?	X		BEP
86	Are the SSCs designed or protected from the effects of design tornado winds?	X		BEP
87	Are the SSCs designed or protected from the effects of design winds?	X		BEP
88	Are the SSCs designed or protected from the effects of tornado missiles?	X		BEP
89	Have the external flood sources been identified?	X		BEP
90	Have the internal flood sources been identified?	X		BEP
91	Have the flood elevations been defined?	X		BEP
92	Are the SSCs designed or protected from the effects of external or internal design floods?	X		BEP
93	Is the free-field response analysis completed?	X		BEP
94	Is the soil-structure interaction (SSI) analysis completed?	X		BEP
95	Are the design basis earthquake time-history ground motions defined?	X		BEP

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
96	Are the design basis earthquake response spectra ground motions defined?	X		BEP
97	Have the evaluation of seismic effects on ground water table, liquefaction, and slope stability completed?	X		BEP
98	Are the methods of seismic analysis and the qualification criteria defined for the concrete structures?	X		BEP
99	Are the methods of seismic analysis and the qualification criteria defined for the steel structures?	X		BEP
100	Are the methods of seismic analysis and the qualification criteria defined for fixed mechanical equipment (tanks, vessels)?	X		BEP
101	Are the methods of seismic analysis and the qualification criteria defined for piping?	X		BEP
102	Are the methods of seismic analysis and the qualification criteria defined for HVAC ducts?	X		BEP
103	Are the methods of seismic analysis and the qualification criteria defined for active mechanical equipment (pumps, compressors, fans, valve operators)?	X		BEP
104	Are the methods of seismic analysis and the qualification criteria defined for electrical equipment?	X		BEP
105	Are the methods of seismic analysis and the qualification criteria defined for electrical distribution systems (conduit and cable trays)?	X		BEP
106	Are the methods of seismic analysis and the qualification criteria defined for I&C?	X		BEP
107	Are the civil-structural drawings complete and verified?	X		BEP
108	Is the building-structures finite element model complete?	X		BEP
109	Are quality standards defined for the concrete and reinforcing steel?	X		BEP
110	Are the concrete structures analyzed and qualified?	X		BEP
111	Are the steel structures analyzed and qualified?	X		BEP
112	Is the design of the foundation basemat complete?	X		BEP
113	Is the design of the containment and confinement features complete?	X		BEP
114	Is the design of access hatches, airlocks complete?	X		BEP

LOI Set 3: Natural Phenomena Hazards and Structural Engineering				
	NPH and Structural Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
115	Is the design of cranes complete?	X		BEP
116	Are the in-structure response spectra complete?	X		BEP
117	Are the buried structures and systems analyzed and qualified?	X		BEP
118	Is the static (fixed) mechanical equipment analyzed and qualified (tanks, vessels)?	X		BEP
119	Are the mechanical distribution systems analyzed and qualified (piping, tubing, ducts)?	X		BEP
120	Is the electrical equipment analyzed and qualified (switchgear, motor control centers, control panels, etc.)?	X		BEP
121	Are the electrical distribution systems analyzed and qualified (conduit and cable trays)?	X		BEP
122	Is the instrumentation and controls equipment analyzed and qualified?	X		BEP
123	Is seismic instrumentation planned and designed?	X		BEP
124	Are the leak tightness tests completed for the containment-confinement SSCs?	X		BEP
125	Are periodic leak tightness tests planned for the containment-confinement SSCs?	X		BEP

LOI Set 4: Fire Protection[7]

LOI Set 4: Fire Protection.				
	Fire Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Does the design package (drawings, specifications and related analyses considered together) comprehensively delineate and conform to the governing fire protection criteria for the facility and site? Do they include references to the requirements from: • Code of Federal Regulations (principally 10 CFR Part 851, 29 CFR Part 1910 and 29 CFR Part 1926); • DOE O 420.1B, *Facility Safety;* • Implementation Guide for DOE Fire Protection and Emergency Services Programs (DOE G 420.1-3); • DOE Fire Protection Design Criteria Standard (DOE-STD-1066-99); • Fire Protection Requirements from the International Building Code (IBC); • Applicable National Fire Protection Association (NFPA) Codes and Standards	X		• DOE O 420.1B, Paragraph 3.a.(3) • 10 CFR Part 851, Appendix C, Paragraph 2.(b) • 29 CFR Part 1910, Subpart L, Appendix A
2	Does the design team include a qualified fire protection engineer(s)?	X		• DOE O 420.1B, Paragraph 3.b.(7) • 10 CFR Part 851, Appendix C, Paragraph 2.(b)
3	Does the design and review process include a formal system to ensure that all fire protection requirements have been met? Does this include documentation of all critical design decisions and the justification for all exemptions and equivalencies from governing fire safety?	X		• DOE O 420.1B, Paragraph 3.b.(3) • DOE G 420.1-3, Section 4.15
4	For HC 1, 2, and 3 nuclear facilities and as otherwise directed by DOE, does the fire protection design reflect the results of a FHA that was performed in accordance with DOE fire safety guidance?	X		• DOE O 420.1B, Paragraph 3.b.(5) • DOE G 420.1-3, Section 4.6

[7] These Lines of Inquiry (LOIs) provide 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 LOIs, as needed.

LOI Set 4: Fire Protection.				
	Fire Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
5	Did site selection and facility design considerations reflect the evaluated capabilities of the local emergency services organization (fire department) to respond in a timely and effective manner to all credible emergencies (e.g. fire, emergency medical, hazardous material, etc.)?	X		• DOE O 420.1B, Paragraph 3.b.(7) • 10 CFR Part 851, Appendix C, Paragraph 2.(a) • 10 CFR Part 851, Appendix C, Paragraph 2.(b)
6	Are all systems, assemblies, components, and materials specified in the design for fire safety listed or approved for their end use by an independent testing authority such as the Underwriters Laboratories?	X		DOE-STD-1066-99, Paragraph 9.1.
7	Is the construction classification(s) of the facility appropriate for the occupancy, and does it conform with the applicable provisions of the IBC?	X		• DOE O 420.1B, Paragraph 3.c.2. • 10 CFR Part 851, Appendix C, Paragraph 2.(b)
8	Are (fire) area special limits in accordance with the governing provisions of the IBC and conform to the requirements of DOE-STD-1066-99 to limit MPFL?	X		• DOE O 420.1B, Paragraph 3.c.(3) • DOE-STD-1066-99, Sections 5.1 and 5.2.
9	Are fire barriers (walls and floor/ceiling assemblies) that separate fire areas minimally (fire) rated at 2-hours in accordance with specific UL listings?	X		• DOE O 420.1B, Paragraph 3.c. (3) • DOE-STD-1066-99, Chapter 4.
10	Does the fire protection design of the exterior shell of the facility reflect a consideration of exposure fire hazards including, but not limited to: transformers, support structures, yard storage, vehicles, and wild land fire risk?	X		DOE O 420.1B, Paragraph 3.c.(3)
11	Does the design for the site include a water distribution system that meets the evaluated demand for firefighting? Does this include water requirements for interior fire sprinkler systems and manual fire fighting by the fire department?	X	X	• DOE O 420.1B, Paragraph 3.c.(1) • DOE-STD-1066-99, Chapter 6 • 29 CFR Part 1926.150
12	Has an automatic fire extinguishing system(s) been provided throughout the facility that conforms to applicable industry standards, unless exclusion is justified in a documented engineering evaluation (exemption request or equivalency	X	X	• DOE O 420.1B, Paragraph 3.c.(4) • DOE-STD-1066-99, Section 5.3 • 29 CFR Part 1910.159

LOI Set 4: Fire Protection.				
	Fire Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	determination)?			
13	Does the design reflect a consideration of the need for redundant fire protection systems where: SC or SS systems are vulnerable to fire damage, and the MPFL exceeds the limits established by DOE?	X		• DOE O 420.1B, Paragraph 3.c.(5) • DOE-STD-1066-99, Section 5.1
14	Has a means to notify building occupants and the site (or local) emergency services organization been included in the design? A complete fire alarm and signaling system will satisfy this provision.	X	X	• DOE O 420.1B, Paragraph 3.c.(7) • 29 CFR Part 1910.165
15	Are there at least two independent and remote means of emergency egress for every area, unless an alternative design has been justified in accordance with building/fire code provisions or engineering evaluation?	X	X	• DOE O 420.1B, Paragraph 3.c.(8) • 29 CFR Part 1910.36 • DOE-STD-1066-99, Chapter 10
16	Have the route(s) of emergency egress travel been provided with exit signage and emergency lighting that conforms to the requirements of industry standards?	X	X	• DOE O 420.1B, Paragraph 3.c.(8) • 29 CFR Part 1910.36
17	Does the design reflect a consideration for the possible need of an interior standpipe system or other related systems and devices (e.g. radio repeaters, fire alarm annunciator panels, zoning of fire alarms) to facilitate the actions of emergency responders?	X		• DOE O 420.1B, Paragraph 3.c.(9) • DOE-STD-1066-99, Paragraph 5.3.6 • 29 CFR Part 1910.158 • 29 CFR Part 1926.150
18	Has the design reflected a consideration of the need to prevent the release of contaminated products of combustion (e.g. smoke, fire-fighting water) beyond the boundaries of the facility and site?	X		DOE O 420.1B, Paragraph 3.c.(10)
19	Where interior automatic fire suppression systems are included in the design, was consideration given to the potential adverse impact on safety due to their inadvertent operation, inactivation, or failure of structural stability?	X		DOE O 420.1B, Paragraph 3.c(12)
20	Did the design reflect consideration of the principles of “Highly Protected Risk” (e.g. reliance upon both “active” and “passive” fire protection) in determining the provision of fire protection features? This includes exceeding code requirements which deemed	X		DOE G 420.1-3, Paragraph 4.17.2

LOI Set 4: Fire Protection.				
	Fire Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	necessary.			
21	Was the classification of fire protection systems as SC or SS validated by a documented engineering analysis?	X		DOE G 420.1-3, Section 4.21.
22	Were fire protection systems that are categorized as SC or SS selected and designed to provide sufficient assurance of their functional integrity and reliability?	X		• DOE O 420.1B, Paragraph 3.c.(12) • DOE G 420.1-3, Paragraphs 4.17.4 and 4.17.5.
23	Was DOE SDC used in the design of fire protection systems that are required to withstand credible seismic events?	X		DOE-STD-1066-99, Section 7.3
24	Were facilities that feature DOE-specific unique hazards (e.g. uranium and plutonium handling facilities) designed to address DOE special hazards fire safety criteria?	X		DOE-STD-1066-99, Chapter 13.
25	Did the design of nuclear facility ventilation systems reflect a consideration of DOE nuclear air filter plenum fire protection criteria as to the provision of fire detection and water spray systems?	X		DOE-STD-1066-99, Chapter 14
26	Does glove box design conform to DOE glove box fire protection criteria as to noncombustible construction and protection by fire detection and suppression systems?	X		DOE-STD-1066-99, Chapter 15
27	Is the facility/site governed by a comprehensive documented fire safety and emergency response program?		X	• DOE O 420.1B, Section 3.b. • 29 CFR Part 1926.150
28	Has the facility/site been provided with an adequate and qualified fire protection staff including; fire protection engineers, technicians, and emergency responders?		X	• DOE O 420.1B, Section 3.b.(7) • 10 CFR Part 851, Appendix C, Paragraph 2.(b)
29	Are fire protection systems inspected, tested, and maintained in accordance with governing DOE criteria and industry standards?		X	29 CFR Part 1910.159
30	Has the fire protection and emergency response program been subject to a formal and documented self-assessment program?		X	• DOE O 420.1B, Paragraph 3.b.(13) • DOE G 420.1-3, Section 4.13
31	Are all employees adequately trained in fire hazard recognition, fire prevention practices,		X	29 CFR Part 1910.1200 DOE G 420.1-3, Section

LOI Set 4: Fire Protection.				
	Fire Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	and the appropriate response to fires commensurate with their responsibilities?			4.8
32	Is there a fire protection-related "issues tracking" system that is effectively monitoring the status of fire protection assessment findings and corrective actions until final resolution is achieved?		X	DOE O 420.1B, Paragraph 3.b.(13)
33	Have fire protection system performance data, fire safety statistics, "lessons learned" and other "feedback" from the site / facility fire safety and emergency response program been disseminated throughout the staff?		X	• DOE G 420.1-3, Paragraph 4.5.6 • DOE O 231.1 and 232.1
34	Has a current (within 3 years) emergency services baseline needs assessment been performed?		X	• DOE O 420.1B, Paragraph 3.b.(8) • DOE G 420.1-3, Section 4.9.
35	Does the facility/site emergency services organization have current procedures (e.g. pre-fire plans) in place that govern the response to fires and related events?		X	• DOE G 420.1-3, Chapters 4.11 and 4.12 • 29 CFR Part 1910.156
36	Have the facility/site emergency response personnel conducted realistic training (e.g. drills) to respond to all credible events?		X	DOE G 420.1-3, Chapters 4.11 and 4.12
37	Are agreements in place with offsite emergency services organizations to respond in the event of a fire or related event?		X	DOE G 420.1-3, Chapters 4.1
THE FOLLOWING SECTIONS ADDRESS NFPA CODE AND STANDARDS[8]				
38	Have fire evacuation drills been conducted on a routine basis?		X	NFPA Standard 1, Section 10.6
39	Does the facility have a documented (fire) emergency plan?		X	NFPA Standard 1, Paragraph 10.9.1
40	Is there a documented procedure that governs the control of open flames and other sources of ignition (e.g. hot work)?		X	NFPA Standard 1, Section 10.11
41	Is there a documented procedure that governs the control of outside storage, with a focus on the control of combustibles and access for emergency vehicles?		X	NFPA Standard 1, Section 10.16

[8] For specific project reviews, it is expected that the review teams will address all applicable NFPA Codes and Standards and develop additional LOIs for the reviews including, but not limited to those delineated below.

LOI Set 4: Fire Protection.				
	Fire Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
42	Is there a (fire prevention) procedure that governs the use of temporary electric power distribution wiring and equipment?		X	NFPA Standard 1, Paragraph 11.1.8
43	Is fire protection adequate for motor fuel dispensing areas/facilities?	X	X	NFPA Standard 1, Chapter 30
44	Has adequate fire safety been provided for areas/processes involving flammable and combustible gases?	X	X	NFPA Standard 1, Chapter 63
45	Has adequate fire protection been provided for areas/processes involving flammable and combustible liquids?	X	X	NFPA Standard 1, Chapter 66
46	Have an adequate number and appropriate type of fire extinguishers been provided throughout the facility, yard area, and vehicles?	X	X	NFPA Standard 10, Chapter 5
47	Have portable fire extinguishers been physically installed as required, with a focus on visibility and access?	X	X	NFPA Standard 10, Chapter 6
48	Were (fire) sprinkler systems designed, installed and maintained by qualified (e.g. NICET certified) contractors?	X	X	NFPA Standard 13, Chapter 4
49	Do the design parameters of installed (fire) sprinkler systems accurately reflect occupancy hazards?	X	X	NFPA Standard 13, Chapter 5
50	Has an inspection(s) been performed to confirm that there are no obstructions to the discharge of water from (fire) sprinklers?		X	NFPA Standard 13, Section 8.5.5
51	Is (fire) sprinkler protection adequate for the types and configuration of storage of commodities within the facility?	X	X	NFPA Standard 13, Chapter 12
52	Have water flow tests been performed on a regular basis to confirm that the sprinkler system, including water flow alarms, is functional?		X	NFPA Standard 13, Chapter 26
53	Where significant quantities of flammable and combustible liquids are present, has adequate physical separation (e.g. fire barriers) been provided to isolate the fire hazard?	X	X	NFPA Standard 30, Chapter 6
54	Where significant quantities of flammable and combustible liquids are present, are the electric lighting and power distribution equipment adequate to mitigate the fire hazard?	X	X	NFPA Standard 30, Chapter 7

LOI Set 4: Fire Protection.				
	Fire Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
55	Where present outside of designated storage and distribution areas, are flammable and combustible liquids contained in appropriate (e.g. listed) containers?		X	NFPA Standard 30, Chapter 9
56	Are hot work operations governed by a permitting process that involves a fire safety qualified permit issuing authority?		X	NFPA Standard 51B, Chapter 4
57	Are trained “fire watches” with portable firefighting equipment provided for all hot work activities that are conducted outside shop areas?		X	NFPA Standard 51B, Chapter 5
58	Are all components of the electrical power distribution system approved for their end use?	X	X	NFPA Standard 70, Chapter 1
59	Are the components of the electrical power distribution system free of physical damage?		X	NFPA Standard 70, Chapter 1
60	Is the facility electrical power distribution system and equipment encompassed by a comprehensive inspection, testing, and maintenance program?		X	NFPA Standard 70, Chapter 1
61	Was the fire alarm and signaling system designed, installed, and maintained by qualified (e.g. NICET certified) contractors?	X	X	NFPA Standard 72, Paragraph 10.4.1.1
62	Are alarm and signaling devices (i.e. pull stations, horns or bells, strobe lights, etc.,) distributed throughout the facility for effective operation in an emergency?	X	X	NFPA Standard 72, Section 10.14
63	Do fire alarms annunciate locally throughout the facility and at a remote, constantly manned and monitored, location?	X	X	NFPA Standard 72, Section 10.16
64	Are the classifications (ratings) of fire doors, dampers and their related hardware (including security-related appurtenances) compatible with the fire rating of the walls and floor/ceiling assemblies in which they are installed?	X	X	NFPA Standard 80, Chapter 4
65	Are signs and other attachments to fire doors limited in extent so as not to affect the fire rating?		X	NFPA Standard 80, Chapter 4
66	Are electrical devices (e.g. hold-open devices, squibs, etc.) that are interconnected with fire doors and dampers	X	X	NFPA Standard 80, Chapter 4

LOI Set 4: Fire Protection.				
	Fire Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	designed, installed and functional as to their intended safety purpose.			
67	Are fire doors free from obstruction?		X	NFPA Standard 80, Chapter 4
68	Are surface materials used in the construction of ventilation systems appropriately noncombustible from the standpoint of their flame spread and smoke development indices?	X		NFPA Standard 90A, Paragraph 4.3.3
69	Where fire detectors and fire dampers have been installed within ductwork, have appropriate provisions (e.g. access panels) been provided for access for inspection, testing and maintenance?	X	X	NFPA Standard 90A, Paragraph 4.3.5.1
70	Does the design of ventilation system ductwork feature appropriate safeguards (e.g. dampers, penetration seals) as required to prevent the passage of products of combustion from one fire area to another?	X	X	NFPA Standard 90A, Chapter 5
71	Are controls (e.g. interlocks) associated with the ventilation system designed and functioning consistent with their desired status during a fire or related event?	X	X	NFPA Standard 90A, Chapter 6
72	Have the fire areas within the facility been categorized correctly as to their occupancy and hazards of contents?	X	X	Life Safety Code (NFPA 101), Sections 6.1 and 6.2
73	Have the number, capacity, and configuration of means of (emergency) egress been correctly determined?	X	X	Life Safety Code (NFPA 101), Sections 7.3 and 7.4
74	Do structural assemblies (walls and floor/ceilings) that define a required means of emergency egress meet minimal fire resistance rating requirements?	X	X	Life Safety Code (NFPA 101), Sections 8.2 and 8.3
75	Have penetrations of fire-rated egress enclosures been protected by appropriately fire rated doors, dampers or penetration seals?	X	X	Life Safety Code (NFPA 101), Paragraph 8.3.4
76	Is interior finish “noncombustible” as defined by DOE fire safety criteria and industry standards?	X	X	Life Safety Code (NFPA 101), Section 10.2
77	Have occupancy-specific life safety features been provided in accordance with the	X	X	Life Safety Code (NFPA 101), Paragraph 6.1.1.1.

LOI Set 4: Fire Protection.				
	Fire Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	applicable requirements of the Life Safety Code?			
78	Have temporary construction, equipment and storage been provided with adequate fire protection?		X	NFPA Standard 241, Chapter 4
79	Have all construction and demolition fire hazards (e.g. wood scaffolding material) been identified through an engineering analysis and mitigated through the provision of appropriate fire protection?		X	NFPA Standard 241, Chapter 5
80	During construction and demolition activities, are at least two remote means of emergency egress being maintained?		X	NFPA Standard 241, Chapter 8
81	During construction and demolition activities are there means provided to notify workers of a fire and to control a fire if one should occur?		X	NFPA Standard 241, Chapter 8
82	Has a complete lightning protection system been provided?	X	X	NFPA Standard 780
83	Is shielding for radiological control purposes designed to be constructed of noncombustible materials?	X	X	NFPA Standard 801, Section 5.7.
84	Is ventilation system ductwork from radiological controlled areas designed to be noncombustible and protected against the effects of exposure fires?	X	X	NFPA Standard 801, Paragraph 5.9.2.1
85	Where drainage and confinement systems are provided to control contaminated runoff. is the capacity sufficient for credible spills?	X	X	NFPA Standard 801, Paragraph 5.10.2.
86	Are nuclear process equipment designed with appropriate safeguards (automatic cut-offs) to mitigate the possibility or consequences of a fire related event?	X	X	NFPA Standard 801, Section 7.1.
87	Have the hazards and risks from wild land fires and related events (e.g. smoke migration) been considered in the design and operation of the facility?	X	X	NFPA Standard 1144, Chapter 4
88	Have vegetation and other combustibles (e.g. structures, storage) been limited within a “defensible space” surrounding the facility?	X	X	NFPA Standard 1144, Chapter 6.

LOI Set 5: Criticality

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Does the design satisfy the requirements of the current applicable revision of (or the version identified in the Code of Record) the consensus nuclear criticality safety standards of ANSI/ANS 8?	X		DOE O 420.1B, Ch (Chapter) III
2	Does the design/planned activities ensure that no single credible event or failure can result in a criticality?	X	X	DOE O 420.1B, Ch III
3	Does the design/planned activities include controls that are derived from the criticality safety evaluation in the preferred order of passive engineered controls, active engineered controls, or lastly administrative controls?	X	X	DOE O 420.1B, Ch III
4	Does the design/planned activities implement the double contingency principle defined in ANSI/ANS 8.1, Nuclear Criticality Safety in Operations with Fissionable Material outside Reactors?	X	X	• DOE O 420.1B, Ch III • ANSI/ANS 8.1 Section 4.2.2
5	Does the design/activities evaluation provide a supporting technical basis whenever an ANSI/ANS standard or other DOE O 420.1B requirement is not being implemented?	X	X	DOE O 420.1B, Ch III
6	Does the design/planned activities and supporting analysis ensure that nuclear criticality safety is controlled by one or more parameters of the system(s) within sub-critical limits and by allowances for process contingencies?	X	X	DOE O 420.1B, Ch III
7	Does the design/process criticality analysis demonstrate controls through one or more of the following as appropriate: • Physical constraints • Use of instrumentation • Chemical means • Reliance on natural or credible course of events • Administrative procedures • Other means?	X	X	• DOE O 420.1B, Ch III • ANSI/ANS 8.1 Section 4.2
8	Are all controlled parameters and their limits specified and the influence of variations of these parameters on the keff understood and	X	X	• DOE O 420.1B, Ch III

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	documented in the design supporting documents?			• ANSI/ANS 8.1 Section 4.2.1
9	Does the design/process rely upon equipment design (geometry), where practicable, in which dimensions are limited rather than administrative controls?	X	X	• DOE O 420.1B, Ch III • ANS/ANS 8.1 Section 4.2.3
10	If the design/process relies upon the use of neutron absorbers, is such reliance consistent with the requirements of section 4.2.4 of ANSI/ANS 8.1, 8.5 (raschig rings) and 8.14 soluble neutron absorbers?	X	X	• DOE O 420.1B, Ch III • ANSI/ANS 8.1, 8.5, & 8.14
11	Are design/activity subcritical limits derived from experiments or calculations in accordance with the requirements of sections 4.2.5 and 4.3 of ANSI/ANS 8.1?	X	X	• DOE O 420.1B, Ch III • ANSI/ANS 8.1 Sections 4.2.5 and 4.3 • DOE-STD-1158-2010, Role of Calculations
12	If required, does the alarm system coverage meet the requirements of section 4.2 of ANSI/ANS 8.3?	X	X	• DOE O 420.1B, Ch III • ANSI/ANS 8.3 Section 4.2
13	If required, does the criticality alarm system design support the requirements of section 4.3 of ANSI/ANS 8.3?	X	X	DOE O 420.1B, Ch III
14	If required, is the dependability of the design for a criticality alarm system consistent with the requirements of ANSI/ANS 8.3 section 4.4?	X	X	DOE O 420.1B, Ch III
15	If required, does the CAS meet the criteria identified in ANSI/ANS 8.3 section 5?	X	X	DOE O 420.1B, Ch III
16	If required, does the CAS design support testing and maintenance meet the criteria identified in ANSI/ANS 8.3, Section 6?	X	X	DOE O 420.1B, Ch III
17	Has it been determined and documented that the entire process will be subcritical under both normal and credible abnormal conditions?	X	X	• ANSI/ANS 8.19 Section 8.1 • DOE-STD-3007-2007, Ch II • DOE-STD-1158-2010, Ch 5
18	Was the identification of normal and abnormal conditions determined in a formal process	X	X	• ANSI/ANS 8.19 Section 8.1

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	involving personnel knowledgeable in operations and the associated processes?			• DOE-STD-3007-2007, Ch II • DOE-STD-1158-2010, Ch 5
19	Did the criticality safety evaluation(s) determine and explicitly identify the controlled parameters and their associated limits upon which nuclear criticality safety depends?	X	X	• ANSI/ANS 8.19 Section 8.2 • DOE-STD-3007-2007, Ch II • DOE-STD-1158-2010, Ch 5
20	Do the criticality safety evaluation(s) demonstrate and document that the effect of changes in these parameters, or in the conditions to which they apply, are understood?	X	X	• ANSI/ANS 8.19 Section 8.2 • DOE-STD-3007-2007, Ch II • DOE-STD-1158-2010, Ch 5
21	Have the criticality safety evaluations been documented with sufficient detail, clarity, and lack of ambiguity to allow independent judgment of results by personnel familiar with the physics of nuclear criticality and the facility operations and its associated criticality safety practices?	X	X	• ANSI/ANS 8.19 Section 8.3 • DOE-STD-3007-2007, Ch II • DOE-STD-1158-2010, Ch 5
22	As part of the design/activity review process and prior to the start of operations, has an independent review been performed that confirms the adequacy of the nuclear criticality safety evaluation(s)?	X	X	• ANSI/ANS 8.19 Section 8.4 • DOE-STD-3007-2007, Ch II • DOE-STD-1158-2010, Ch 5
23	Is the design/process such that the movement of fissile materials is controlled in accordance with documented procedures in a manner, which ensures criticality safety?	X	X	• ANSI/ANS 8.19 Section 9.1 • DOE-STD-1158-2010, Ch 6
24	Is the design/process such that access to areas where fissile material is handled, processed, or stored controlled?	X	X	• ANSI/ANS 8.19 Section 9.4 • DOE-STD-1158-2010, Ch 6
25	Does the design/process ensure that controls on fissile material parameters such as spacing, mass, density/concentration, and geometry are maintained to provide sub criticality under all normal and credible abnormal conditions?	X	X	• ANSI/ANS 8.19 Section 9.5 • DOE-STD-1158-2010, Ch 6

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
26	Does the design/process and supporting analyses give additional consideration to equipment that may enter or is in a period of extended shutdown where fissile material characteristics can change?	X	X	• ANSI/ANS 8.19 Section 9.6 • DOE-STD-1158-2010, Ch 6
27	Does the design/process development include the evaluation of the need for a criticality alarm system for all activities in which the inventory of fissionable materials in individual unrelated areas exceeds 700g of U-235, 500g of U-233, 450 g of Pu-239 or 450 g of any combination of these three isotopes?	X	X	ANSI/ANS 8.3 Section 4.2.1
28	If the design/activities involve significant quantities of other fissionable isotopes has the evaluation been performed if quantities exceed the subcritical mass limits specified in ANSI/ANS 8.15?	X	X	• ANSI/ANS 8.3 Section 4.2.1 • DOE-STD-3007-2007, Ch II
29	Has an evaluation been performed for all processes in which neutron moderators or reflectors more effective than water are present or unique material configurations exist such that critical mass requirements may be less than the typical subcritical mass limits identified in ANSI/ANS 8.3 Section 4.2.1?	X	X	• ANSI/ANS 8.3 Section 4.2.1 • DOE-STD-3007-2007, Ch II
30	Does the design/process modification call for installation of a CAS meeting the requirements of ANSI/ANS 8.3 in areas were personnel would be subject to excessive radiation dose?	X	X	• ANSI/ANS 8.3 Section 4.2.2 • DOE-STD-1158-2010, Ch 7
31	Does the evaluation for the need of a CAS assume 2.0E19 fissions for the accident of concern or document the basis for use of a different value?	X	X	• ANSI/ANS 8.3 Section 4.2.2 • DOE-STD-1158-2010, Ch 7
32	Does the design/process provide for criticality alarm coverage, if required, with a means to detect a criticality accident and to signal that prompt protective action is required?	X	X	• ANSI/ANS 8.3 Section 4.2.3 • DOE-STD-1158-2010, Ch 7
33	Does the CAS provide uniform signals throughout the system that are distinctive from other signals or alarms which require a response different than that necessary in the event of a criticality accident?	X	X	• ANSI/ANS 8.3 Section 4.3.1 • DOE-STD-1158-2010, Ch 7
34	Does the CAS provide for signal generators that are automatically and promptly actuated upon detection of a criticality accident?	X	X	• ANSI/ANS 8.3 Section 4.3.2 • DOE-STD-1158-

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
				2010, Ch 7
35	Does the CAS ensure that the signal generators continue to function even if the radiation falls below the alarm point?	X	X	• ANSI/ANS 8.3 Section 4.3.3 • DOE-STD-1158-2010, Ch 7
36	Does the CAS provide for manual resets with limited access outside the areas that require evacuation?	X	X	• ANSI/ANS 8.3 Section 4.3.3 • DOE-STD-1158-2010, Ch 7
37	Does the CAS ensure that for all occupied areas where personnel protective action is required the number and placement of CAS signal generators is adequate to notify personnel promptly throughout those areas?	X	X	• ANSI/ANS 8.3 Section 4.3.5 • DOE-STD-1158-2010, Ch 7
38	Does the CAS ensure that the audio generators produce an overall sound pressure of at least 75 dB but not less than 10 dB above the maximum ambient noise level for which audio coverage is to be provided?	X	X	• ANSI/ANS 8.3 Section 4.3.6 • DOE-STD-1158-2010, Ch 7
39	Does the CAS X ensure that the audio generators do not produce an A-weighted sound level in excess of 115 dB at the ear of an individual?	X	X	• ANSI/ANS 8.3 Section 4.3.7 • DOE-STD-1158-2010, Ch 7
40	Does the CAS provide visual signals or other alarm means for areas with very high audio background or mandatory hearing protection?	X	X	• ANSI/ANS 8.3 Section 4.3.8 • DOE-STD-1158-2010, Ch 7
41	Does the CAS provide a means for avoidance of false alarms that still provides the compliance with detection criterion specified in ANSI/ANS 8.3 section 5.6?	X	X	• ANSI/ANS 8.3 Section 4.4.1 • DOE-STD-1158-2010, Ch 7
42	Does the CAS provide for emergency power in areas where activities will continue during power outages? If not are provisions made for continuous monitoring with portable instruments?	X	X	• ANSI/ANS 8.3 Section 4.4.3 • DOE-STD-1158-2010, Ch 7
43	Does the CAS meet the reliability criteria identified in ANSI/ANS 8.3 section 5.1?	X	X	• ANSI/ANS 8.3 Section 5.1 • DOE-STD-1158-2010, Ch 7
44	Is the CAS such that the system vulnerability meets the requirements of section 5.2 of	X	X	• ANSI/ANS 8.3 Section 5.2

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	ANSI/ANS 8.3?			• DOE-STD-1158-2010, Ch 7
45	Does the CAS system design ensure that the system will remain operational in the event of the site-specific seismic design basis earthquake?	X	X	• ANSI/ANS 8.3 Section 5.3 • DOE-STD-1158-2010, Ch 7
46	Does the CAS system design provide a visible or audible warning signal at some normally occupied location to indicate a system malfunction or the loss of primary power?	X	X	• ANSI/ANS 8.3 Section 5.4 • DOE-STD-1158-2010, Ch 7
47	Will the CAS produce the criticality alarm signal within one-half second of detector recognition of a criticality accident?	X	X	• ANSI/ANS 8.3 Section 5.5 • DOE-STD-1158-2010, Ch 7
48	Is the CAS designed to respond to the minimum accident of concern (20 rad/min at 2 meters from the reacting material) for areas with nominal shielding? If, a different minimum accident of concern is used, is the basis documented?	X	X	• ANSI/ANS 8.3 Section 5.6 • DOE-STD-1158-2010, Ch 7
49	Will the CAS so that it will respond to a minimum duration radiation transient of 1 msec?	X	X	• ANSI/ANS 8.3 Section 5.7.1 • DOE-STD-1158-2010, Ch 7
50	Is the CAS design such that the alarm trip point will minimize the probability of a spurious alarm and still respond to the minimum accident of concern?	X	X	• ANSI/ANS 8.3 Section 5.7.2 • DOE-STD-1158-2010, Ch 7
51	Does the CAS provide for spacing of the detectors consistent with the selected alarm trip point and with the detection criterion?	X	X	• ANSI/ANS 8.3 Section 5.8 • DOE-STD-1158-2010, Ch 7
52	Has detector location and spacing been selected to minimize the effect of shielding by massive equipment or materials?	X	X	• ANSI/ANS 8.3 Section 5.8 • DOE-STD-1158-2010, Ch 7
53	Are storage facilities and structures designed to preclude unacceptable arrangements or configurations of the materials?	X	X	ANSI/ANS 8.7 Section 4.2.3
54	Does the storage provide engineered controls to maintain configuration and spacing arrays?	X	X	ANSI/ANS 8.7 Section 4.2.6

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
55	Are containers in the storage area designed to prevent the accumulation of water?	X	X	ANSI/ANS 8.7 Section 4.2.7
56	Does the storage take into consideration sprinkler systems and the potential for criticality from the operation of these systems, including the runoff water?	X	X	ANSI/ANS 8.7 Section 4.2.8
57	If the facility/activity is designed to incorporate shielding and confinement into the criticality safety design, does facility meet the following criteria: • All operations and manipulations involving fissile and fissionable materials are conducted remotely by persons located outside the shielded area, and • Shielding and confinement provided are adequate to meet the radiation dose limits set forth in ANSI/ANS 8.10?	X	X	ANSI/ANS 8.10 Section 4.1
58	Does the shielding and confinement ensure that personnel do not receive a whole body dose of 25 rem following a criticality accident?	X	X	ANSI/ANS 8.10 Section 4.2.1
59	Does the shielding and confinement ensure that the whole body dose received by an individual outside the restricted area surrounding the facility will not exceed 0.5 rem?	X	X	ANSI/ANS 8.10 Section 4.2.1
60	Does the shielding and confinement system ensure that the systems will withstand physical damage that could cause breach of confinement or injury to personnel in the event of a criticality accident?	X	X	ANSI/ANS 8.10 Section 4.2.3
61	If the design/process incorporates fixed neutron absorbers are they designed to maintain their geometrical relationship with fissionable materials during the intended operating life?	X	X	ANSI/ANS 8.21 Section 5.1.1
62	Does the design/process provide a means of verification to determine that the design, safety, and operating requirement are met for all neutron absorber system components?	X	X	ANSI/ANS 8.21 Section 5.1.1.1
63	Does the design/process include assessment of the operating environment for degradation considerations?	X	X	ANSI/ANS 8.21 Section 5.1.1.2
64	Was the fixed neutron absorber designed to maintain its designed neutron absorption	X	X	ANSI/ANS 8.21 Section 5.1.1.2.1

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	capacity during its intended operating life including all credible conditions of neutron moderation and reflection?			
65	Were radiation effects on the neutron absorber over its expected life evaluated?	X	X	ANSI/ANS 8.21 Section 5.1.1.2.2
66	Does the process/design make allowances for process material variations, for manufacturing tolerances, for uncertainties in the absorber density and distribution, and for uncertainties in the nuclear properties of the neutron absorber?	X	X	ANSI/ANS 8.21 Section 5.1.1.3
67	Is the neutron absorber such that the criticality safety function is not compromised for all credible operational and natural phenomena events for the facility or equipment?	X	X	ANSI/ANS 8.21 Section 5.1.2
68	Does the neutron absorber system prevent inadvertent removal, displacement or alteration of its components?	X	X	ANSI/ANS 8.21 Section 5.1.3
69	Does the design of equipment and facilities incorporating fixed neutron absorbers incorporate human factors engineering practices for installation, operation, and maintenance of fixed neutron absorbers?	X	X	ANSI/ANS 8.21 Section 5.1.4
70	Does the design of the neutron absorber system consider the requirements of fissionable material accountability and other safety disciplines?	X	X	ANSI/ANS 8.21 Section 5.1.5
71	Does the Contractor have a written criticality safety policy?	X	X	• ANSI/ANS 8.19, Section 4.2 • DOE-STD-1158-2010, Ch 1
72	Are all fissionable material handlers and their supervisors familiar with the criticality safety policy?	X	X	• ANSI/ANS 8.19, Section 4.2 • DOE-STD-1158-2010, Ch 1
73	How is compliance to the Contractor criticality safety policy required of all program personnel performing work?	X	X	• ANSI/ANS 8.19, Section 4.2 • DOE-STD-1158-2010, Ch 1
74	How is compliance to the criticality safety policy measured?	X	X	• ANSI/ANS 8.19, Section 4.2 • DOE-STD-1158-2010, Ch 1

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
75	Are the roles and responsibilities of the CSEs documented?	X	X	• ANSI/ANS 8.19, Section 4.3 • DOE-STD-1158-2010, Ch 1
76	Are the roles and responsibilities of the NCS Manager and Organization documented?	X	X	• ANSI/ANS 8.19, Section 4.3 • DOE-STD-1158-2010, Ch 1
77	Are the roles and responsibilities of the CSRs documented?		X	• ANSI/ANS 8.19, Section 4.3 • DOE-STD-1158-2010, Ch 1
78	Is there a clear distinction between the roles of the CSR and the CSE?		X	• ANSI/ANS 8.19, Section 4.3 • DOE-STD-1158-2010, Ch 1
79	Is line management assigned responsibility for criticality safety?		X	• ANSI/ANS 8.19, Section 4.3 • DOE-STD-1158-2010, Ch 1
80	Has the Contractor assigned responsibility for oversight of the NCS program?		X	• ANSI/ANS 8.19, Section 4.3 • DOE-STD-1158-2010, Ch 1
81	Does the Contractor have adequate criticality safety staff?		X	• ANSI/ANS 8.19, Section 4.4 • DOE-STD-1158-2010, Ch 1
82	Does the NCS Staff have unilateral, unscheduled access to the facility and operations personnel?		X	• ANSI/ANS 8.19, Section 4.4 • DOE-STD-1158-2010, Ch 1
83	Does the Contractor have a plan or policy to assure the NCS Staff is familiar with fissionable operations?		X	• ANSI/ANS 8.19, Section 4.4 • DOE-STD-1158-2010, Ch 1
84	Does the Contractor issue requirements for the qualification and training of NCS Staff, including subcontractors?		X	• ANSI/ANS 8.19, Section 4.4 • DOE-STD-1158-2010, Ch 1

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
85	Has management established a qualification program for the criticality safety staff?		X	• ANSI/ANS 8.19, Section 4.5 • DOE-STD-1158-2010, Ch 1
86	Does the training and qualification program meet the requirements of DOE-STD-1135-99 or other programs approved in accordance with DOE O 420.1B?		X	• ANSI/ANS 8.19, Section 4.5 • DOE-STD-1158-2010, Ch 1
87	Do all members of the NCS Staff have technical degrees in physics or nuclear engineering or another technical degree, or other training and experience judged appropriate by NCS management?		X	• ANSI/ANS 8.19, Section 4.5 • DOE-STD-1158-2010, Ch 1
88	How are the requirements and recommendations of DOE O 426.2 and ANSI/ANS 8.26 implemented?		X	• ANSI/ANS 8.19, Section 4.5 • DOE-STD-1158-2010, Ch 1
89	Are the criticality safety staff qualification documents readily available? (a) Can the initial and ongoing qualification of staff members be quickly observed from the training records? (b) Are the records consistent with the training requirements in the site criticality safety program?		X	• ANSI/ANS 8.19, Section 4.5 • DOE-STD-1158-2010, Ch 1
90	Has management provided sufficient numbers of qualified NCS staff members? The following can be indicators regarding sufficient numbers of staff. (a) Is the backlog of evaluations excessive? (b) Is Operations complimentary, dissatisfied, or non-committal with regard to field response for questions and issues? (c) How much overtime is used? (d) Are infractions unresolved for more than a few days?		X	• ANSI/ANS 8.19, Section 4.5 • DOE-STD-1158-2010, Ch 1
91	Has management defined audit requirements and criteria for the NCS Program?		X	• ANSI/ANS 8.19, Section 4.6 • DOE-STD-1158-2010, Ch 1
92	Who is responsible for monitoring the criticality safety program?		X	• ANSI/ANS 8.19, Section 4.6

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
				• DOE-STD-1158-2010, Ch 1
93	Are criticality safety related performance metrics in place and used by management to monitor the effectiveness of the program? • Do the metrics provide clear indication of whether the program is improving? • Do the metrics encourage continuous improvement? • Do the criticality safety performance metrics encourage self-reporting of deficiencies? • Do the criticality safety performance metrics promote practices that prevent repeat criticality safety infractions of the same type or for the same operation or process? • Are the criticality safety performance metrics measurable and objective? • Do the criticality safety performance metrics encourage development of a strong staff and program by measuring performance? Areas to be monitored may include: (a) the training and qualification program of nuclear criticality safety staff; (b) professional development; (c) participation in the American Nuclear Society Nuclear Criticality Safety Division; (d) preparation of technical papers; (e) attendance of criticality safety courses; and (f) teaching of criticality safety courses? **Note:** This list is not exhaustive.		X	• ANSI/ANS 8.19, Section 4.6 • DOE-STD-1158-2010, Ch 1
94	Are assessment applications geared to a specific operation (i.e. vertical slice assessments) used to indicate how well the general program is working?		X	• ANSI/ANS 8.19, Section 4.6 • DOE-STD-1158-2010, Ch 1
95	Are all deficiencies related to criticality safety entered in a corrective action tracking system?		X	• ANSI/ANS 8.19, Section 4.6 • DOE-STD-1158-2010, Ch 1
96	Are mechanisms in place to validate closure of all criticality safety related deficiencies?		X	• ANSI/ANS 8.19, Section 4.6 • DOE-STD-1158-

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
				2010, Ch 1
97	Does management maintain awareness of criticality safety deficiencies through the use of a corrective action tracking system?		X	• ANSI/ANS 8.19, Section 4.6 • DOE-STD-1158-2010, Ch 1
98	Is there a program or procedure for trending deficiencies in the criticality safety program?		X	• ANSI/ANS 8.19, Section 4.6 • DOE-STD-1158-2010, Ch 1
99	Does the Contractor perform assessments of compliance to operating procedures?		X	• ANSI/ANS 8.19, Section 4.6 • DOE-STD-1158-2010, Ch 1
100	Does the Contractor assess implementation of conduct of operations?		X	• ANSI/ANS 8.19, Section 4.6 • DOE-STD-1158-2010, Ch 1
101	Is comparison to experiment used in preference to calculations for determining subcritical limits?	X	X	• ANSI/ANS 8.19, Section 8.1 • DOE-STD-1158-2010, Ch 5
102	Does the NCS Staff take full advantage of simplifying methods, bounding calculations, critical experiment data, handbook data, etc. where appropriate to minimize dependence upon Monte Carlo techniques?	X	X	• ANSI/ANS 8.19, Section 8.1 • DOE-STD-1158-2010, Ch 5
103	Where hand calculations, handbook data, experiment data, etc., are used, are the limitations and proper use of each recognized?	X	X	• ANSI/ANS 8.19, Section 8.1 • DOE-STD-1158-2010, Ch 5
104	Are calculations validated by comparison to applicable experiment benchmark data?	X	X	• ANSI/ANS 8.19, Section 8.1 • DOE-STD-1158-2010, Ch 5
105	Is a sensitivity and uncertainty analysis technique (e.g., TSUNAMI) used to select and verify applicability of the selected benchmarks?	X	X	• ANSI/ANS 8.19, Section 8.1 • DOE-STD-1158-2010, Ch 5
105	How are calculation methods validated? If validation is being reviewed, consult ANSI/ANS-8.24, “Validation of Neutron	X	X	• ANSI/ANS 8.19, Section 8.1 • DOE-STD-1158-

LOI Set 5: Criticality.				
	Criticality Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	Transport Methods for Nuclear Criticality Safety Calculations?" for more detailed guidance			2010, Ch 5
106	Is the validation, including treatment of bias and bias uncertainty, documented?	X	X	• ANSI/ANS 8.19, Section 8.1 • DOE-STD-1158-2010, Ch 5
107	Does the Contractor have a structured and defined process for the response to a criticality event for facilities where criticality is a credible event? Does the process include emergency response procedures?		X	• ANSI/ANS 8.19, Section 10.2 • DOE-STD-1158-2010, Ch 7
108	Does the response to a criticality event result in a prompt evacuation as identified in the emergency procedures?		X	• ANSI/ANS 8.23, Section 6 • DOE-STD-1158-2010, Ch 7
109	Is the process clearly defined for reentry into the facility or areas following a criticality event?		X	• ANSI/ANS 8.23, Section 6 • DOE-STD-1158-2010, Ch 7
110	Does the contractor have scheduled training drills and exercises for criticality events?		X	• ANSI/ANS 8.23, Section 8 • DOE-STD-1158-2010, Ch 7

LOI Set 6: Mechanical

LOI Set 6: Mechanical.				
	Mechanical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Does the facility design include multiple layers of protection to prevent or mitigate the unintended release of radioactive materials to the environment (defense in depth [DID])?	X		DOE O 420.1B Ch 1-3.b.(1)
2	Does the mechanical design address the following DID elements? • Choosing an appropriate site; • Minimizing the quantity of material at risk; • Applying conservative design margins and quality assurance; • Using successive physical barriers for protection against radioactive releases; • Using multiple means to ensure critical safety functions are met	X		DOE O 420.1B Ch 1-3.b.(2)
3	Does the mechanical design address and have provisions for the following? • Facilitating safe deactivation, decommissioning, and decontamination at the end of facility life, including incorporation of design considerations during the operational period that facilitate future decontamination and decommissioning; • Facilitating inspections, testing, maintenance, repair, and replacement of SSCs as part of a reliability, availability, and maintainability program with the objective that the facility is maintained in a safe state; and • Keeping occupational radiation exposures within statutory limits and ALARA?	X		DOE O 420.1B Ch 1-3.b.(3)
4	Does the design include provisions for engineered controls to provide double contingency for criticality safety (e.g. geometrically safe equipment)?	X		DOE O 420.1B Ch III-3.a.(4)
5	Are facility SSCs designed, constructed and operated to withstand NPHs and ensure: • confinement of hazardous materials; • protection of occupants of the facility and the public; • continued operation of essential facilities; and • protection of government property?	X		DOE O 420.1B Ch IV-3.a.(1)

LOI Set 6: Mechanical.				
	Mechanical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
6	Does the design and construction of new facilities and major modifications to existing facilities and SSCs address: • potential damage to and failure of SSCs resulting from both direct and indirect NPH events; • common cause/effect and interactions resulting from failures of other SSCs; and • compliance with seismic requirements **Note**: Seismic requirements are from Executive Order (EO)12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction (as amended by E.O. 13286, Amendment of Executive Orders, and Other Actions, in Connection With the Transfer of Certain Functions to the Secretary of Homeland Security, January 5, 1990)	X	X	DOE O 420.1B Ch IV-3.a.(2)
7	Are additions and modifications to existing DOE facilities designed and constructed such that they do not degrade SSC performance during an NPH occurrence?	X	X	DOE O 420.1B Ch IV-3.a.(3)
8	Does the mechanical design address the appropriate requirements of the NPH LOIs contained in Attachment 4?	X	X	DOE O 420.1B Ch IV
9	Does the design ensure that mechanical equipment classified as safety significant or safety class that with an active safety function has the required redundancy as identified in section 5.1.1.2 of DOE G 420.1-1?	X	X	DOE G 420.1-1 Section 5.2.2
10	Does the ventilation system design provide the necessary level of confinement and redundancy as specified in the safety analysis?	X	X	DOE G 420.1-1 Section 5.2.2.1
11	Does the design provide for periodic maintenance, inspection, and testing of components?	X	X	DOE G 420.1-1 Section 5.2.2.1
12	Does the design of filters, absorbers, scrubbers and other air treatment components include adequate shielding to ensure that occupational exposure limits are not exceeded during maintenance and inspection activities?	X	X	DOE G 420.1-1 Section 5.2.2.1
13	Does the design of safety-significant and safety-class ventilation system designs include adequate instrumentation to monitor and assess performance with necessary alarms for annunciation of abnormal or unacceptable	X	X	DOE G 420.1-1 Section 5.2.2.1

LOI Set 6: Mechanical.				
	Mechanical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	operation?			
14	Does the design include manual or automatic protective control features to prevent or mitigate an uncontrolled release of radioactive and/or hazardous material to the environment and to minimize the spread of contamination within the facility?	X	X	DOE G 420.1-1 Section 5.2.2.1
15	Does the design ensure that vent streams potentially containing significant concentrations of radioactive and/or hazardous materials are processed through an off gas cleanup system before being exhausted to the environment?	X	X	DOE G 420.1-1 Section 5.2.2.1
16	Does the cleanup system remove particulates and noxious chemicals and control the release of gaseous radionuclides?	X	X	DOE G 420.1-1 Section 5.2.2.1
17	Is the design of safety-significant and safety-class off gas systems commensurate with the sources and characteristics of the radioactive and chemical components of the off gas air stream to prevent or mitigate the uncontrolled releases of radioactive and/or hazardous materials to the environment?	X	X	DOE G 420.1-1 Section 5.2.2.1
18	Is the design of the ventilation and off gas systems safety-class and safety-significant components consistent with the codes identified in table 5.2 of DOE G 420.1-1?	X	X	DOE G 420.1-1 Section 5.2.2.1
19	Does the design of process equipment include the necessary considerations and requirements to ensure the confinement function is adequately performed and that the release of radioactive and/or hazardous material to the environment is prevented?	X	X	DOE G 420.1-1 Section 5.2.2.2
20	Are safety-class and safety-significant process equipment providing passive confinement (piping, tanks, holding vessels, etc.) designed to suitably conservative criteria?	X	X	DOE G 420.1-1 Section 5.2.2.2
21	Does the design ensure that the redundancy criteria as described in Section 5.1.1.2 of DOE G 420.1-1 is applied to the design of safety-class SSCs that involve active confinement process equipment (pumps, valves, etc.)?	X	X	DOE G 420.1-1 Section 5.2.2.2
22	Does the design consider the redundancy for safety-significant SSCs that involve active confinement process equipment?	X	X	DOE G 420.1-1 Section 5.2.2.2

LOI Set 6: Mechanical.				
	Mechanical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
23	Does the design consider the applicable codes for safety-significant and safety-class process equipment as identified in table 5.3 of DOE G 420.1-1?	X	X	DOE G 420.1-1 Section 5.2.2.2
24	Does the design and supporting hazards analysis consider the failure modes for mechanical handling equipment used to move radioactive materials including mid-operational failures and the recovery methods for such occurrences?	X	X	DOE G 420.1-1 Section 5.2.2.2
25	Do the designs for remote handling equipment accommodate periodic maintenance and inspection?	X	X	DOE G 420.1-1 Section 5.2.2.2
26	Is remote handling equipment designed using the relevant codes as identified in Table 5.4 of DOE G 420.1-1?	X	X	DOE G 420.1-1 Section 5.2.2.2
27	• Does the facility/design ensure that all HEPA filters are functioned properly? • Are the HEPA filters purchased and tested according to the general requirements of this Section 4 and the specific requirements of Sections 5 and 6 of DOE-STD-3020-2005?	X	X	DOE-STD-3020-2005, Section 4
28	Does the facility have provisions to ensure that HEPA filters, prior to use, can meet the following criteria and are delivered to the Filter Testing Facility (FTF) for additional quality assurance testing? • HEPA filters that are used in confinement ventilation systems in Category 1 and Category 2 nuclear facilities that perform a safety function in accident situations, or are designated as important to safety (i.e., safety class or safety significant per DOE-STD-3009-94); • HEPA filters necessary for habitability systems (e.g., filters that protect workers who must not evacuate in emergency situations because of the necessity to shut down or control the situation); and • For all other applications where HEPA filters are used in confinement ventilation systems for radioactive airborne particulate, develop and document an independent tailored filter QA testing program that achieves a high degree of fitness for service. The program should include the testing of a sample of filters at the FTF with		X	DOE-STD-3020-2005, Section 4

LOI Set 6: Mechanical.				
	Mechanical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	sufficient sample size to provide sufficient statistical power and significance to assure the required level of performance. **Note:** This is directed by the Secretary of Energy's June 4, 2001 memorandum, 100 percent Quality Assurance Testing of HEPA Filters at the DOE Filter Test Facility.			
29	• Are all HEPA filters qualified per ASME AG-1 and Section 6.1 of DOE-STD-3020-2005? • Does the filter media comply with ASME AG-1?	X	X	DOE-STD-3020-2005, Section 4
30	Are all HEPA filters tested by the manufacturer and in addition, those identified to be tested by the FTF to the following criteria? • Penetration at 100% of manufacturer rated airflow; • Penetration at 20% of manufacturer rated airflow for filters rated at 125 ACFM and greater; and • Airflow resistance at rated airflow	X	X	DOE-STD-3020-2005, Section 4
31	Do HEPA filter specifications in the design and installation ensure that the filters meet the mandatory performance requirements for HEPA filters as identified in section 5 of DOE-STD-3020-2005?	X	X	DOE-STD-3020-2005, Section 5
32	Does the facility/design ensure that only the filters manufactured under a Quality Assurance Program, which has been evaluated with documented evidence of compliance to the requirements of ASME NQA-1, are to be used/installed at the facility?	X	X	DOE-STD-3020-2005, Section 6
33	Does filter procurement and fabrication allow positive identification of the grades of source materials used in construction, and permit positive identification of the roll (or production run for separator less filters) of filter media used in the completed filter?	X	X	DOE-STD-3020-2005, Section 6
34	Are penetration and resistance production tests and inspections conducted in accordance with ASME AG-1, FC-5000 or FK-5000 and with documented manufacturer's procedures? Are the results traceable to specific lots of completed filters?	X	X	DOE-STD-3020-2005, Section 6
35	Does the facility have provisions to ensure that a filter design is again qualified when any change is	X	X	DOE-STD-3020-2005, Section 6

LOI Set 6: Mechanical.				
	Mechanical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	made to design, construction, or composition of construction materials that could affect filter performance, including normal service and off-normal service? **Note:** Examples of changes that require requalification include: composition of filter media, manufacture of gasket or sealant materials, and materials or methods used to assemble filter cases.			
36	Is packaging shipping and storage of HEPA filters for use in the facility consistent with the requirements and guidance in DOE-STD-3020-2005?		X	DOE-STD-3020-2005, Section 7
37	Does the design of the piping systems document the selection of appropriate materials to allow for corrosion/erosion over the service life of the systems with consideration of the forces and conditions under which the systems will be performing?	X	X	DOD-HDBK-1132-99, Section 3.1
38	Does the design process ensure that piping systems that perform safety-related functions are to be designed and fabricated to more rigorous standards than other fluid service piping? **Note:** In accordance with ASME B31.3, Process Piping, Category M Fluid Service may be designated for design, material and component selection, fabrication and erection, and examination and inspection of these systems.	X	X	DOD-HDBK-1132-99, Section 3.1
39	Does the design process ensure that piping systems that handle radioactive fluids, regardless of design pressures and temperatures, are categorized as Normal Fluid Service, at a minimum, in accordance with ASME B31.3 for design, material, and component selection, fabrication and erection, and examination and inspection?	X	X	DOD-HDBK-1132-99, Section 3.1
40	Do facility procedures ensure that maintenance activities that involve repairs, replacements, and modifications to existing piping systems are performed in compliance with the original Code of Record used in the original design and installation of these systems?	X	X	DOD-HDBK-1132-99, Section 3.1
41	Does the design ensure that combined fire protection and potable water service or combined process water and potable water systems are avoided to the extent practicable?	X	X	DOD-HDBK-1132-99, Section 3.1

LOI Set 6: Mechanical.				
	Mechanical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
42	Does the design ensure that backflow preventers and vacuum breakers are used as appropriate?	X	X	DOD-HDBK-1132-99, Section 3.1
43	Does the design of supports for piping in compressible flow service consider the weight of the line filled with water for hydrostatic testing?	X	X	DOD-HDBK-1132-99, Section 3.1
44	Does the design provide suitable flexibility at building interfaces to protect against differential settlement or seismic activity?	X	X	DOD-HDBK-1132-99, Section 3.1
45	Are components that create large pressure drops, such as valves and orifices, designed to minimize the effects of cavitation and flashing?	X	X	DOD-HDBK-1132-99, Section 3.1
46	Does the initial design conservatively estimate the piping load on equipment nozzles (e.g., vessels, heat exchanges, pumps, etc.)?	X	X	DOD-HDBK-1132-99, Section 3.1
47	Does the design ensure that the mid-span deflection due to dead weight loading is limited to no more than 1/8 inch for lines that are required to drain, and to no more than 1/2 inch for lines that are not required to drain?	X	X	DOD-HDBK-1132-99, Section 3.1
48	Does the design for buried pipe provide for a trench of sufficient width and depth to provide necessary bedding and cover, depending on traffic volume to facilitate joining, trapping, and future maintenance concerns?	X	X	DOD-HDBK-1132-99, Section 3.1
49	Does the design analysis for buried pipe consider soil, surface, internal pressure, thermal growth, soil settlement, water hammer, and seismic loads, as applicable?	X	X	DOD-HDBK-1132-99, Section 3.1
50	Does the design ensure that underground piping is buried beneath the frost line and has heat tracing/insulation to prevent freezing?	X	X	DOD-HDBK-1132-99, Section 3.1
51	Does the design ensure that primary and secondary piping are supported and anchored and that supports are adequate to carry the weight of the lines and maintain proper alignment?	X	X	DOD-HDBK-1132-99, Section 3.1
52	Does the design ensure that pipe guides and anchors are provided to keep pipes in accurate alignment; direct the expansion movement; and prevent buckling, swaying, and undue strain?	X	X	DOD-HDBK-1132-99, Section 3.1
53	Does the design ensure that steam lines slope 1/8 inch per foot in the direction of steam flow and have adequate provisions for condensate considerations?	X	X	DOD-HDBK-1132-99, Section 3.1

LOI Set 6: Mechanical.				
	Mechanical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
54	Does the design ensure that each low point has a steam trap and free blow with drainage provisions to a lower elevation?	X	X	DOD-HDBK-1132-99, Section 3.1
55	Does the design ensure that drip legs include a steam trap and blow down drains?	X	X	DOD-HDBK-1132-99, Section 3.1
56	Does the design include provisions to drain condensate from the upstream side of isolation valves?	X	X	DOD-HDBK-1132-99, Section 3.1
57	Does the design ensure that stream traps provide adequate capacity to accommodate condensation loads during warm-up as well as during normal operation and to compensate for line size, length, and insulation type and thickness?	X	X	DOD-HDBK-1132-99, Section 3.1
58	Does the design ensure that aramid fiber gasket material is used in any steam or condensate service?	X	X	DOD-HDBK-1132-99, Section 3.1
59	Does the design provide for protection of the piping systems for damage caused by severe hydraulic transients?	X	X	DOD-HDBK-1132-99, Section 3.1
60	Does the design include use of vacuum-breaker valves (or check valves as appropriate) in situations where water-column separation can occur?	X	X	DOD-HDBK-1132-99, Section 3.1
61	Does the design include the use of purge gases and processes as appropriate to ensure that flammable/explosive concentrations of gasses are not achieved in piping and vessel process systems?	X	X	DOD-HDBK-1132-99, Section 3.2
62	Does the design ensure the appropriate use of positive displacement pumps?	X	X	DOD-HDBK-1132-99, Section 3.3
63	Does the design ensure that gate valves are not used for throttling?	X	X	DOD-HDBK-1132-99, Section 3.4
64	Does the design ensure that globe valves are used primarily for throttling service only unless system flow reverses, and the globe valve serves as a stop valve?	X	X	DOD-HDBK-1132-99, Section 3.4
65	Does the design ensure that simple check valves without external actuation are never used as stop valves but instead are used as flow reversal preventers?	X	X	DOD-HDBK-1132-99, Section 3.4
66	Does the design use butterfly valves for stop valves or for throttling purposes in water systems?	X	X	DOD-HDBK-1132-99, Section 3.4

LOI Set 6: Mechanical.				
	Mechanical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
67	Does the design use ball valves for bubble-tight stop valves in relatively clean fluid services?	X	X	DOD-HDBK-1132-99, Section 3.4
68	Does the design use plug and diaphragm valves for stop valves as appropriate?	X	X	DOD-HDBK-1132-99, Section 3.4

LOI Set 7: Electrical

LOI Set 7: Electrical.				
	Electrical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Are safety class electrical systems designed to preclude single point failure?	X	X9	DOE O 420.1B and Attachment 2 Chapter 1, Section 3.b.(8)
2	Does the design and supporting analysis address the interfaces from safety systems and non-safety systems such as electrical?	X	X	• DOE G 420.1-1 Section 5.1.2.2 • DOE-STD-1189-2008, Chapter 4
3	Does the analysis identify the electrical system components with a safety function, specifically those that provide power to systems and components that require electrical power in order to perform their safety functions?	X	X	• DOE G 420.1-1 Section 5.2.3 • DOE-STD-1189-2008, Chapter 4
4	Are all electrical systems that provide actuation or motive force to safety equipment identified as safety-class or safety-significant as appropriate?	X	X	DOE G 420.1-1 Section 5.2.3
5	Have the redundancy requirements for electrical systems pertaining to normal and alternative power sources been analyzed on a case-by-case basis? **NOTE:** For safety-significant systems, redundancy is not required if it can be shown that there is sufficient response time to provide an alternative source of electrical power.	X	X	• DOE G 420.1-1 Section 5.2.3 • DOE-STD-1189-2008, Chapter 4
6	Does the electrical design consider the ANSI/IEEE Safety Class 1E requirements and incorporate them as appropriate for safety-class systems in nonreactor nuclear facilities?	X	X	DOE G 420.1-1 Section 5.2.3
7	Does the electrical design consider the national codes and standards identified in Table 5.5 of DOE G 420.1-1 for electrical systems and components?	X	X	DOE G 420.1-1 Section 5.2.3
8	Does the design ensure that instrumentation, control, and alarm systems can perform their safety functions? Note: The safety functions of instrumentation, control, and alarm systems are to provide information on out-of-tolerance	X	X	DOE G 420.1-1 Section 5.2.4

[9] These design criteria are included in the operations and disposition phases because design of electrical and instrument systems to support ongoing operations and disposition activities are generally anticipated.

LOI Set 7: Electrical.				
	Electrical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	conditions/abnormal conditions; ensure the capability for manual or automatic actuation of safety systems and components; ensure safety systems have the means to achieve and maintain a fail-safe shutdown condition on demand under normal or abnormal conditions; and/or actuate alarms to reduce public or site-personnel risk (e.g., effluent monitoring components and systems).			
9	Does the design of safety-class and safety-significant instrumentation and control systems incorporate sufficient independence, redundancy, diversity, and separation to ensure that all safety-related functions associated with such equipment can be performed under postulated accident conditions as identified in the safety analysis?	X	X	• DOE G 420.1-1 Section 5.2.4 • DOE-STD-1189-2008, Chapter 4
10	Have safety-significant components been evaluated as to the need for redundancy on a case-by-case basis?	X	X	DOE G 420.1-1 Section 5.2.4
11	Does the design ensure that under all circumstances, no failure of non-safety equipment will prevent safety-class instrumentation, controls, and alarms from performing their safety functions?	X	X	• DOE G 420.1-1 Section 5.2.4 • DOE-STD-1189-2008, Chapter 4
12	Does the design ensure that safety-significant and safety-class instrumentation, control, and alarm-system are designed to provide adequate accessibility for inspection, maintenance, calibration, repair, or replacement?	X	X	• DOE G 420.1-1 Section 5.2.4 • DOE-STD-1189-2008, Chapter 4
13	Does the design ensure that safety-class instrumentation, control, and alarm systems provide the operators sufficient time, information, and control capabilities to perform the following safety functions: • Readily determine the status of critical facility parameters to ensure compliance with the limits specified in the Technical Safety Requirements; • Initiate automatic or manual safety functions; • Determine the status of safety systems required to ensure proper mitigation of the consequences of postulated accident conditions and/or to safely shut down the facility?	X	X	DOE G 420.1-1 Section 5.2.4

LOI Set 7: Electrical.				
	Electrical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
14	Does the instrumentation, control and alarm systems design consider the national codes and standards identified in Table 5.7 of DOE G 420.1-1?	X	X	DOE G 420.1-1 Section 5.2.4
15	Has the contractor implemented a comprehensive electrical safety program appropriate for the activities at their site?		X	• 10 CFR 851 • DOE-HDBK-1092-2004
16	Does the contractor electrical safety program meet the applicable electrical safety codes and standards referenced in §851.23?		X	• 10 CFR 851 • DOE-HDBK-1092-2004
17	Does the design consider the following factors as appropriate: • number of required operating personnel; • number and types of processes to be operated; • duties of operating personnel; • control panel and consoles arrangement; • operator man-machine interface; • instrument equipment functions; • testing considerations; • maintenance considerations; • aesthetics; • lighting methods and intensities; • communications facilities; • control center location relative to the rest of the plant; • control center access and egress pathways; • security and safety considerations; • office and utility room requirements; • computer room; • software engineering area; • ambient noise levels and abatement devices; • HVAC requirements— ambient temperature, air quality, and humidity; • fire protection requirements; • wiring methods and requirements (including fiber optics); • static electricity discharge requirements; • grounding requirements;	X	X	DOE-HDBK-1132-99, Section 2

LOI Set 7: Electrical.				
	Electrical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• essential documents storage and reference area; • electromagnetic compatibility; • reliability; • power requirements; • human factors/ergonomics; • the need for uninterruptible power supplies; and • the need for DC electrical sources?			
18	Does the design/facility use standard off-the-shelf electrical materials and equipment used on installations only if they have been tested and labeled by a nationally recognized testing laboratory (international standards organization or recognized testing agency)?	X	X	DOE-HDBK-1132-99, Section 2.1
19	Has on-site acceptance testing been performed on major electrical components and systems as appropriate?	X	X	DOE-HDBK-1132-99, Section 2.1
20	Is the use of electrical tubing avoided in areas where it may be subject to sever damage and is PVC used for conduits encased in concrete duct lines?	X	X	DOE-HDBK-1132-99, Section 2.1
21	Is flexible conduit used for conduit connections to equipment subject to vibrations?	X	X	DOE-HDBK-1132-99, Section 2.1
22	Are outdoor installations appropriate for their application?	X	X	DOE-HDBK-1132-99, Section 2.1
23	Is aluminum conduit used in atmospheres where steel is unsuitable?	X	X	DOE-HDBK-1132-99, Section 2.1
24	Are steel conduits used to route power cables to motors supplied from variable-frequency controllers to minimize noise to and from adjacent circuits and do variable-frequency controllers include electrical filters?	X	X	DOE-HDBK-1132-99, Section 2.1
25	Are all receptacles with their power source labeled, including UPS-critical circuits?	X	X	DOE-HDBK-1132-99, Section 2.1
26	Do electrical penetrations through a fire barrier have an approved fire barrier seal?	X	X	DOE-HDBK-1132-99, Section 2.1
27	Are penetrations through confinements designed to minimize leakage?	X	X	DOE-HDBK-1132-99, Section 2.1
28	Does the use of cable trays consider the following items as appropriate? • Use cable trays for large, multiple-cable	X	X	DOE-HDBK-1132-99, Section 2.1

LOI Set 7: Electrical.				
	Electrical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	applications in both interior and exterior locations. • Arrange cable tray runs in stacks by descending voltage levels with the highest voltage at the top. • Consider the minimum bending radius of all medium-voltage cables to be routed through the tray system during the selection of the cable tray bending radius (horizontal and vertical). • Consider the location of monorails, equipment removal spaces, and floor hatches in the layout design so that raceways do not interfere with equipment removal. • Use of drip shields where piping lines cross over cable trays. • Cable trays should be located away from heat sources such as steam lines and hot process piping wherever possible. When locating cable trays away from heat sources is not possible, analyses may be required to determine if high-temperature cable and/or heat shielding may be required. Cable trays should also be located away from potential fire hazards such as lube oil and fuel oil storage tanks. • Raceways which require multiple cable trays may be installed in a vertical or horizontal (side by side) arrangement as required by the facility configuration.			
29	For design/modification of existing facilities are the following guidelines considered when using existing raceways: • Additional new cables should not exceed the allowable raceway fill guidelines of IEEE-1185; • When power cables are added, evaluate the current capacity of all cables(existing and new) within the raceway; • Minimum bending radius of new cables should not be violated when pulled through existing raceways; • Evaluate the conduit and tray support system to stay within design loads when new cables are added; • When pulling cables in existing trays, refer to	X	X	DOE-HDBK-1132-99, Section 2.1

LOI Set 7: Electrical.				
	Electrical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	IEEE-1185 for guidance for avoiding damage to cables?			
30	Are demand and diversity factors considered in calculating service capacity, substation, and feeder loads?	X	X	DOE-HDBK-1132-99, Section 2.2
31	Does the design address properly address loads that require a high degree of service reliability?	X	X	DOE-HDBK-1132-99, Section 2.2
32	Does the design ensure that standby or emergency power systems are used to support systems or equipment components whose operating continuity is determined to be vital by the design authority for protection of health, life, property, and safeguards and security systems?	X	X	DOE-HDBK-1132-99, Section 2.6
33	Are interior lighting systems designed in accordance with the guidance in DOE-HDBK-1132-99?	X	X	DOE-HDBK-1132-99, Section 2.4
34	Are exterior lighting systems designed in accordance with the guidance in DOE-HDBK-1132-99?	X	X	DOE-HDBK-1132-99, Section 2.5
35	Does the design of control centers/control rooms address the following factors? • number of required operating personnel; • number and types of processes to be operated; • duties of operating personnel; • control panel and consoles arrangement; • operator man-machine interface; • instrument equipment functions; • testing considerations; • maintenance considerations; • aesthetics; • lighting methods and intensities; • communications facilities; • control center location relative to the rest of the plant; • control center access and egress pathways; • security and safety considerations; • office and utility room requirements; • computer room; • software engineering area;	X	X	DOE-HDBK-1132-99 Section 4.1

LOI Set 7: Electrical.				
	Electrical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• ambient noise levels and abatement devices; • HVAC requirements-ambient temperature, air quality, and humidity; • fire protection requirements; • wiring methods and requirements (including fiber optics); • static electricity discharge requirements; • grounding requirements; • essential documents storage and reference area; • electromagnetic compatibility; • human factors/ergonomics (see IEEE-1023, ISA RP60.3); • reliability; and • power requirements.			
36	Does the design address the criteria identified in DOE-HDBK-1132-99 for DCSs as appropriate?	X	X	DOE-HDBK-1132-99 Section 4.2
37	Does the design address the criteria identified in DOE-HDBK-1132-99 for Programmable Logic Controllers as appropriate?	X	X	DOE-HDBK-1132-99 Section 4.3
38	Do the design/operations of the facility provide a systematic approach for identifying, verifying, prioritizing, and documenting the requirements for process alarms?	X	X	DOE-HDBK-1132-99 Section 4.4
39	Do the design/operations of the facility provide capability of alarm pattern recognition and suppression of alarms by group, status, function, or mode?	X	X	DOE-HDBK-1132-99 Section 4.4
40	Do the design/operations of the facility provide an alarm only when the operator is required to take action to avert an abnormal event?	X	X	DOE-HDBK-1132-99 Section 4.4
41	Are alarms presented to the operator in an organized and optimized manner to reduce the confusion caused by multiple alarms?	X	X	DOE-HDBK-1132-99 Section 4.4
42	Do the design/operations of the facility report alarms hierarchically to the operator to prevent a single event from causing a cascading of alarms?	X	X	DOE-HDBK-1132-99 Section 4.4
43	Do the design/operations of the facility provide capability to advise the operator of the appropriate response to an alarm or to trigger an automatic response?	X	X	DOE-HDBK-1132-99 Section 4.4

LOI Set 7: Electrical.				
	Electrical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
44	Does the design address the criteria in DOE-HDBK-1132-99 to minimize electrical noise in wiring?	X	X	DOE-HDBK-1132-99 Section 4.5
45	Does the design address the criteria in DOE-HDBK-1132-99 for lightning protection of instruments?	X	X	DOE-HDBK-1132-99 Section 4.6
46	Does the design address the criteria in DOE-HDBK-1132-99 for analyzers?	X	X	DOE-HDBK-1132-99 Section 4.7
47	Does the design address the criteria in DOE-HDBK-1132-99 for solenoid valves?	X	X	DOE-HDBK-1132-99 Section 4.8
48	Does the design address the general criteria for instrument installation identified in DOE-HDBK-1132-99?	X	X	DOE-HDBK-1132-99 Section 4.9.1
49	Does the design address the instrument location criteria identified in DOE-HDBK-1132-99?	X	X	DOE-HDBK-1132-99 Section 4.9.2
50	Does the design address the pressure instrument criteria identified in DOE-HDBK-1132-99?	X	X	DOE-HDBK-1132-99 Section 4.9.3
51	Does the design ensure that temperature instruments are installed in a thermo well to allow removal without process disturbance?	X	X	DOE-HDBK-1132-99 Section 4.9.4
52	Does the design provide adequate space to allow removal of thermocouples, resistance temperature detectors, thermal bulbs, or indicators?	X	X	DOE-HDBK-1132-99 Section 4.9.4
53	Does the design of flow instruments address the criteria identified in DOE-HDBK-1132-99?	X	X	DOE-HDBK-1132-99 Section 4.9.5
54	Does the design of liquid level instruments address the criteria identified in DOE-HDBK-1132-99?	X	X	DOE-HDBK-1132-99 Section 4.9.6
55	Does the design of instrument systems ensure that they do not freeze under adverse weather conditions and when handling high-freeze-point materials?	X	X	DOE-HDBK-1132-99 Section 4.9.8

LOI Set 8: Instrumentation and Control

LOI Set 8: Instrumentation and Control.				
	Instrumentation and Control Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Has the design of SC and SS instrumentation and control systems incorporated sufficient independence, redundancy, diversity, and separation to ensure that all safety-related functions associated with such equipment can be performed under postulated accident conditions as identified in the safety analysis? **Note:** Guidance from DOE-STD-1195 should be used for the design of safety-significant safety instrumented systems (SISs) for DOE non-reactor nuclear facilities.	X		DOE G 420.1-1, Section 5.2.4
2	Are the SS and SC instrumentation, control, and alarm-systems designed to ensure accessibility for inspection, maintenance, calibration, repair, or replacement?	X		DOE G 420.1-1, Section 5.2.4
3	Has the design of the SC instrumentation, control, and alarm systems provided the operators sufficient time, information, and control capabilities to perform the following safety functions? • Readily determine the status of critical facility parameters to ensure compliance with the limits specified in the Technical Safety Requirements. • Initiate automatic or manual safety functions. • Determine the status of safety systems required to ensure proper mitigation of the consequences of postulated accident conditions and/or to safely shut down the facility.	X		DOE G 420.1-1, Section 5.2.4
4	Have the ANSI, IEEE and NFPA commercial standards been considered for the design, installation, and testing of the instrumentation, control, and alarm components?	X		DOE G 420.1-1, Section 5.2.4, Table 5.7
	Is the DOE-STD-1195 guidance used for the design of SS SISs, which are identified in the safety basis documents (CSDR, PSDR, and PDSA? **Note:** This DOE standard was developed based on ANSI/ISA 84.00.01-2004 Functional Safety: Safety Instrumented Systems for the Process Industry Sector. It is not applicable to SC SISs.	X		DOE-STD-1195-2011, Section 1.2
5	Have the good practices documented in DOE-HDBK-1132-99 been considered for instrumentation and controls design?	X		DOE-HDBK-1132-99, Section 4

LOI Set 8: Instrumentation and Control.				
	Instrumentation and Control Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
Safety Significant (SS) Safety Instrumented Systems (SISs)				
6	Is ANSI/ISA 84.00.01-200410 being used for the design of SS SISs (not SC SISs)? **Note:** The standards are listed in DOE G 420.1-1 for SC instrumentation and control systems. However, the listed standards include some design requirements that are unwarranted for the design of SS SISs used in DOE nonreactor nuclear facilities (e.g., the application of nuclear power industry standards call for single-failure-proof designs, when other options to achieve adequate reliability might be more appropriate and cost effective).	X	X	DOE-STD-1195-2011, Section 2.1 DOE-STD-1195-2011, Appendix C
7	Are the safety software quality assurance requirements and guidance of DOE 414.1D and DOE G 414.1-4 being implemented to meet the objectives of ISA 84.00.01-2004, Part 1, Clause 12, Requirements for Application Software, Including Selection Criteria for Utility Software?	X	X	DOE-STD-1195-2011, Section 2.2 DOE-STD-1195-2011, Appendix F
8	Is there justification or rational provided for CGD used to approve the selection of components and subsystems in an SIS in lieu of the ANSI/ISA 84.00.01-2004, Part 1, Clause 11.5, methodology of acceptance by qualification to IEC 61508, Functional Safety of Electrical/Electronic/ Programmable Electronic Safety-Related Systems and/or “prior use”?	X	X	DOE-STD-1195-2011, Section 2.3
9	Is ASME Nuclear Quality Assurance (NQA)-1, Quality Assurance Requirements for Nuclear Facility Applications, used to establish the CGD process? **Note:** The goal of CGD is to provide a reasonable assurance that an item procured will perform its intended safety function, as specified by design requirements.	X	X	DOE-STD-1195-2011, Section 2.3

[10]ANSI/ISA 84.00.01-2004, Part 1, design methodology should not be used for instrumented systems in the following applications because they are more appropriately covered by other industry standards such as National Fire Protection Association (NFPA) standards and American Nuclear Society 8.3, Criticality Accident Alarm Systems. Users should judge whether the SS SISs are more appropriately covered by any other industry standards. DOE G 420.1-1 identifies the standards that would be applied to systems such as: (a) Evacuation alarms (e.g., nuclear incident monitors, fire alarms, and public address systems); (b) Fire protection/detection systems (covered by NFPA standards); and (c) Support systems (e.g., electrical power systems, instrument air systems).

LOI Set 8: Instrumentation and Control.				
	Instrumentation and Control Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	

10	Are the following critical characteristics for CGD being addressed when assessing the acceptability of an SIS that utilizes software for meeting the design attributes?
	• Failure rate of an item such as:
	  • unsafe/dangerous failure rate (detected and undetected); or,
	  • safe failure rate (spurious trip rate)
	• Safe failure state, and safe recovery
	• Environmental design constraints
	• Software critical characteristics (e.g., build date, release name, part or catalog number, traceability matrix, etc.)
	• Diagnostic coverage
	• Response time
	• Accuracy
	• Isolation capability of component/system from non-safety interfaces (i.e., communication inputs and outputs)
	• Unused and unintended or prohibited functions
	• Supplier catalog and part number
	• Supplier technical manual and product specification
	• Conformance to national codes and standards
	Note: The above list is not all inclusive. Users should develop the list for specific SS SIS design requirements.
		X	X	DOE-STD-1195-2011, Section 2.3

11	Are the requirements of ANSI/ISA 67.04.01, Set points for Nuclear Safety-Related Instrumentation, being implemented for SS SIS set point development, including indications and alarms?	X	X	DOE-STD-1195-2011, Section 2.4
12	Are power sources (i.e., electric power or instrument air) provided with backup power sufficient to fulfill the requirements of the SIS safety function, except in cases where the design is fail-safe on loss of power?	X	X	DOE-STD-1195-2011, Section 2.5
13	Are the processes for performing life-cycle management for SIS been defined, including identifying the organization(s) responsible for implementing them? **Note:** A key aspect of the implementation of ANSI/ISA 84.00.01-2004 is effective control over each stage of the SIS life cycle to ensure proper	X	X	• DOE-STD-1195-2011, Section 2.6 • DOE-STD-1195-2011, Appendix C, Section A.3

LOI Set 8: Instrumentation and Control.				
	Instrumentation and Control Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	initial design, proper installation, effective operation and maintenance, and configuration control. The life-cycle stages can be fulfilled by conformance to the ANSI/ISA 84.00.01-2004 requirements or by conformance to DOE orders, manuals, standards, and guides that provide equivalent processes and methods for the life-cycle stages of the safety instrumented functions.			
14	Does the design of SIS take into account human-machine interfaces and their limitations, and follow good HFE practices as required by ANSI/ISA 84.00.01-2004, Part I, Clause 11.2.6? **Note:** HFE involves diverse areas (e.g., information display, user-system interaction, alarm management, operator response, control room design, and system maintainability), which affect all aspects of a system's development and modification.	X	X	• DOE-STD-1195-2011, Section 2.7 • DOE-STD-1195-2011, Appendix G
15	Is an HFE Plan developed for the SS SIS, which defines the required participants and human factors activities, including the documentation, review, and approval of each activity?	X	X	• DOE-STD-1195-2011, Section 2.7 • DOE-STD-1195-2011, Appendix G
16 +	Are the details of the HFE Plan developed in accordance with DOE G 420.1-1, guided or supplemented by information in NUREG 0700, Human-System Interface Design Review Guidelines, ANSI/ISA 18.2, Management of Alarm Systems for the Process Industries, and other HFE references given Table G-1 of DOE-STD-1195-2011?	X	X	• DOE-STD-1195-2011, Section 2.7 • DOE-STD-1195-2011, Appendix G
17	Does the HFE process follow the applicable requirements of DOE O 414.1D for software and hardware configuration controls?	X	X	• DOE-STD-1195-2011, Section 2.7 • DOE-STD-1195-2011, Appendix G
18	Are the SS SISs secured from electronic vulnerabilities, including unauthorized and/or inappropriate access that may harm system integrity and safety? **Note:** DOE-STD-1195-2011 does not provide details of security requirements for SIS design. ANSI/ISA 84.00.01-2004, Clause 11.7.2.2, provides some basic access security protection measures. Users should consult applicable DOE 470 and 205 series directives and other industry standards to ensure the design meets the security	X	X	DOE-STD-1195-2011, Section 2.8

LOI Set 8: Instrumentation and Control.				
	Instrumentation and Control Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	requirements.			
19	Does the SS SIS design development process address the potential security vulnerabilities in each phase of the system life cycle? Are the requirements commensurate with the risk and magnitude of harm resulting from unauthorized and inappropriate access, use, disclosure, disruption, or destruction of the system?	X		DOE-STD-1195-2011, Section 2.8
20	Has a method been established for determining the appropriate SIL for SS safety instrumented function for DOE nonreactor nuclear facilities? **Note:** The SIL provides design input to an SS SIS that is credited with reducing the risk of a hazardous event by itself or in combination with other features to an acceptable level, as defined in the safety basis documentation. The SIL determination methodology defined in DOE-STD-1195-2011 shall not be used as an input or requirement to hazard/safety analysis, classification of Structures, Systems, and Components (SSC) as safety class (SC) or SS, or crediting of SSCs, specific administrative controls (SAC), or administrative controls (AC) to prevent or mitigate hazardous conditions.	X	X	DOE-STD-1195-2011, Appendix A and Appendix D
21	Have the SIL calculations been verified as required in Section 11.9.1 of ANSI/ISA 84.00.01-2004, Functional Safety: Safety Instrumented Systems for the Process Industry Sector?	X	X	DOE-STD-1195-2011, Appendix C and Appendix D
22	Has the average probability of failure on demand of the SS SISs been verified to determine if they meet their SIL?	X	X	DOE-STD-1195-2011, Appendix E

LOI Set 9: Radiation Protection

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
LOIs Related to Design				
1	• Have measures been taken to maintain radiation exposure in controlled areas As Low As Reasonably Achievable (ALARA) through engineered and administrative controls? • Were physical design features (e.g., confinement, ventilation, remote handling, and shielding) the primary methods used? • Were administrative controls employed only as supplemental methods to control radiation exposure? **Note:** For design of new facilities or modifications of existing facilities.	X	X	10CFR835.1001(a)
2	Were optimization methods used to assure that occupational exposure is maintained ALARA in developing and justifying facility design and physical controls?	X	X	• 10CFR835.1002(a) • DOE-HDBK-1132-99, 1.3.2
3	• Was the design objective for controlling personnel exposure from external sources of radiation in areas of continuous occupational occupancy (2000 hours per year) to maintain exposure levels below an average of 0.5 millirem (5 μSv) per hour and as far below this average as is reasonably achievable? • Are the design objectives for exposure rates for potential exposure to a radiological worker where occupancy differs from the above ALARA less than 20 percent of the applicable standards in §835.202?	X	X	• 10CFR835.1002(b) • DOE-STD-1098, 381
4	Regarding the control of airborne radioactive material, was the design objective, under normal conditions, to avoid releases to the workplace atmosphere and in any situation, to control the inhalation of such material by workers to levels that are ALARA; to normally use confinement and ventilation?	X	X	• 10CFR835.1002(c) • DOE-HDBK-1132-99, 1.3.3 • DOE-STD-1098, 381
5	Did the design or modification of a facility and the selection of materials include features that facilitate operations, maintenance, decontamination, and decommissioning?	X	X	• 10CFR835.1002(d) • DOE-HDBK-1132-99, 2.12.1 • DOE-STD-1098, 381

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
6	• Were the type and level of hazards determined for each functional area, the attendant degree of risk established, and the possibility of cross contamination considered? • Were, wherever possible, work areas with compatible contaminants located together to simplify design criteria related to air supply and exhaust, waste disposal, decontamination, and cross contamination?	X		DOE G 420.1-1, 3.4 DOE-HDBK-1132-99, 2.12.1
7	Were radioactive and hazardous material contamination control requirements considered in the design to minimize the potential for contamination spread?	X		DOE G 420.1-1, 3.4
8	Were office areas located in common-use facilities (e.g., data computation and processing, word processing, etc.) and away from process areas to minimize risks to workers of exposure to radioactive and/or hazardous materials?	X		DOE G 420.1-1, 3.4
9	Does the building layout provide protection from the hazards associated with the handling, processing, and storing of radioactive and/or hazardous materials?	X		DOE G 420.1-1, 3.4.1
10	Has additional space been provided for temporary or additional shielding in the event radiation levels are higher than anticipated?	X		DOE G 420.1-1, 3.4.1
11	Does the arrangement and location of hazardous process equipment and its maintenance provisions provide appropriate protective and safety measures as applicable?	X		DOE G 420.1-1, 3.4.1
12	Does the building design accommodate prompt return to safe conditions in emergencies and allow ready access for and protection of workers in areas where manual corrective actions are required and in areas that contain radiation monitoring equipment readouts?	X		DOE G 420.1-1, 3.4.1
13	Does the facility layout provide specific control and isolation, if possible, of quantities of flammable, toxic, and explosive gases, chemicals, and other hazardous materials admitted to the facility?	X		DOE G 420.1-1, 3.4.1
14	Does the facility design accommodate the requirements for safeguards and security, emergency egress, and area access control for	X		• 10 CFR 835.501(e) • DOE G 420.1-1, 3.4.2

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	worker protection? If these requirements appear to conflict, does life safety take precedence? Are specific requirements for access control implemented as specified by 10 CFR 835 for radiological hazards?			
15	Was surveillance equipment located and sufficient space provided for relative ease of routine testing and maintenance activities?	X		DOE G 420.1-1, 3.5
16	Were accessible inspection covers designed to allow for visual inspection, provided, and located such that necessary routine inspections can be conducted with minimum disruption to the facility or equipment operation? Examples include ducting and process piping systems.	X		DOE G 420.1-1, 3.5
17	Does the facility design include features that provide for ease of routine maintenance without a subsequent mission reduction? **Note:** Examples include providing sufficient clearance around equipment to accommodate change out of large components and providing permanent ladder(s) and platform(s) access to lubrication and equipment areas.	X		• DOE G 420.1-1, 3.5 • DOE-HDBK-1132-99, 2.12.2
18	Does the design facilitate deactivation by incorporating facility features that aid in the removal of surplus radioactive and chemical materials; storage tank cleanout and maintenance; stabilization of contamination and process materials; and the removal of hazardous, mixed, and radioactive wastes?	X	X	• DOE G 420.1-1, 3.7.1 • DOE-HDBK-1132-99, 2.12.2
19	• Does the facility design incorporate measures to simplify decontamination of areas that may become contaminated with radioactive or hazardous materials? • Are items such as service piping, conduits, and ductwork kept to a minimum in potential contamination areas and arranged to facilitate decontamination? • Are walls, ceilings, and floors in areas vulnerable to contamination finished with washable or strippable coverings? • Are metal liners used in areas that have the potential to become highly contaminated? • Are cracks, crevices, and joints filled and finished smooth to prevent accumulation of contaminated material?	X		• DOE G 420.1-1, 3.7.2 • DOE-HDBK-1132-99, 2.12.1

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Does the facility design incorporate features that will facilitate decontamination to achieve facility decommissioning, to increase the potential for other uses, or both?			
20	Are localized liquid-transfer systems, with emphasis on localized batch solidification of liquid waste, designed to avoid long runs of buried contaminated piping used? Are special provisions included in the design to ensure the integrity of joints in buried pipelines?	X		• DOE G 420.1-1, 3.7.3 • DOE-HDBK-1132-99, 2.12.2
21	Are the exhaust filtration components of the ventilation systems located at or near individual enclosures to minimize long runs of internally contaminated ductwork?	X		• DOE G 420.1-1, 3.7.3 • DOE-HDBK-1132-99, 2.12.3
22	Does the design include equipment (including effluent decontamination equipment) that precludes, to the extent practicable, the accumulation of radioactive or other hazardous materials in relatively inaccessible areas, including curves and turns in piping and ductwork? Note: Accessible, removable covers for inspection and cleanouts are encouraged.	X		• DOE G 420.1-1, 3.7.3 • DOE-HDBK-1132-99, 2.12.2
23	Is modular radiation shielding used in lieu of or in addition to monolithic shielding walls?	X		DOE G 420.1-1, 3.7.3
24	Are there provisions for flushing and/or cleaning contaminated or potentially contaminated piping systems?	X		DOE G 420.1-1, 3.7.3
25	Are there provisions for suitable clearances, where practical, to accommodate remote handling and safety surveillance equipment required for future decontamination and decommissioning?	X		• DOE G 420.1-1, 3.7.3 • DOE-HDBK-1132-99, 2.12.1
26	Are there lifting lugs on large tanks and equipment?	X		DOE G 420.1-1, 3.7.3
27	Do piping systems that carry contaminated or potentially contaminated liquid free drain via gravity?	X		DOE G 420.1-1, 3.7.3
28	Is control of radiological exposures of workers, the public, and the environment in accordance with Section 4.1.1.2 of DOE O 420.1, 10 CFR 835, and 10 CFR 834 (proposed)? **Note:** Additional guidance is contained in the DOE Radiological Control Manual (DOE/EH-	X	X	DOE G 420.1-1, 4.2.1

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	0256T).			
29	Are occupied operating areas for normal operating conditions designed not to exceed the airborne concentration limits of 10 CFR 835?	X	X	DOE G 420.1-1, 4.2.2
30	• Are devices to monitor individual exposures to external radiation and to warn personnel of radioactive contamination used in accordance with 10 CFR 835? • Is air sampling equipment placed in strategic locations to detect and evaluate airborne contaminant conditions at work locations? • Are continuous air monitors with preset alarms provided to give early warning of significant releases of radioactive materials? • Do air monitoring and warning systems comply with the requirements of 10 CFR 835 with consideration for additional guidance contained in ANSI N13.1?	X	X	• DOE G 420.1-1, 4.2.2 • DOE-HDBK-1132-99, 1.3.4
31	Has shielding been designed to limit the total external dose during normal operations to the annual exposure limit values as specified in 10 CFR 835?	X	X	DOE G 420.1-1, 4.2.3
32	Has permanent shielding been designed and installed consistent with the guidance provided in ANSI N43.3?	X		DOE G 441.1-1C, 7.4.0.0
33	Was the effect of temporary shielding evaluated prior to its installation? Is the installation, use, and removal of temporary shielding controlled by procedures and in accordance with RCS 314? **Note:** RCS is DOE-STD-1098-99, Radiological Control.		X	• DOE G 441.1-1C, 7.4.0.0 • DOE-STD-1098, 314
34	Is straight-line penetration of shield walls avoided to prevent radiation streaming?	X	X	DOE-HDBK-1132-99, 1.3.2
35	Are alarms for loss of ventilation or differential pressure provided on primary confinement systems (glove boxes or hoods) and were they considered on secondary confinement systems (rooms)?	X	X	DOE G 420.1-1, 4.2.3
36	Have change rooms for changing into and out of protective clothing been designed to ensure that clean clothing (personal clothing) and contaminated clothing (protective clothing) are segregated?	X	X	• DOE G 420.1-1, 4.2.3 • DOE-HDBK-1132-99, 1.3.4

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
37	Have personnel decontamination facilities been located close to areas that are potential sources of contamination?	X		• DOE G 420.1-1, 4.2.3 • DOE-HDBK-1132-99, 1.3.4
38	Have doors and/or access panels in exempt shielded, shielded, and unattended installations been equipped with one or more fail-safe safety interlocks to prevent irradiation of an individual [ANSI N43.3(6.5.2)]?	X	X	DOE G 441.1-1C, 7.4.0.2
39	If an area radiation monitor is incorporated into a safety interlock system, is the circuitry designed such that a failure of the monitor either prevents normal access into the area or operation of the RGD?	X	X	DOE G 441.1-1C, 7.4.0.2
40	Are all the RGD warning lights red or magenta for consistency? Have a sufficient number of lights been installed so that at least one light is easily visible from all reasonably occupied areas that may have dangerous radiation levels and from reasonable avenues of approach to such areas?	X	X	DOE G 441.1-1C, 7.4.0.4
41	Has at least one interlocked warning light been used in all circumstances? Does the interlocked warning light provide visual indication that radiation is being produced, and is it used in conjunction with an interlocked safety device which restricts physical access to a radiation beam or field?	X	X	DOE G 441.1-1C, 7.4.0.4
42	Do sampling and monitoring systems provide adequate and accurate measurements under normal operations, anticipated operational occurrences, and accident conditions? Are monitoring systems calibrated at least annually according to appropriate national standards?	X	X	DOE-HDBK-1132-99, 1.3.4
43	Have exhaust outlets that may contain radioisotopes, other than ambient levels of those naturally occurring in the environment, been provided with monitoring systems? As necessary, has special equipment for stack effluent dispersal and tracking been considered for installation? Such monitoring provides data useful for dispersion analysis of effluent materials.	X	X	DOE-HDBK-1132-99, 1.3.4
44	Do stack monitoring systems have central (i.e., control room or radiation monitoring office) readout and alarm panels that are accessible	X	X	DOE-HDBK-1132-99, 1.3.4

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	after an accident to evaluate internal conditions?			
45	Are radiation monitoring, alarm, and warning systems that must function during a loss of normal power provided with an emergency UPS (internal or external on-line)?	X	X	DOE-HDBK-1132-99, 1.3.4
46	Has the use of multiple barriers been emphasized when necessary to restrict the movement of radioactive liquid waste that has the potential for human contact or for reducing groundwater quality below requirements?	X		DOE-HDBK-1132-99, 2.8.2
47	• Has measurement and analysis capability been provided to determine the volume and radioactivity of wastes fed to collection tank(s)? • Have provisions been made for analyzing liquids prior to transfer? • Is each transfer line identified individually? • Are instrumentation and control systems used to provide monitoring and control capabilities associated with confinement, nuclear criticality safety, and/or radiation protection?	X		DOE-HDBK-1132-99, 2.8.2
48	• Have individual lines been used for each waste stream fed to central collection tanks, where necessary, to prevent chemical reactions or introduction of contaminants such as complexing agents that could interfere with waste decontamination? • Has the use of traps in radioactive liquid waste lines been avoided, and has piping been designed to minimize entrapment and build-up of solids in the system? • Have bypasses that would allow waste streams to be routed around collection tanks been avoided? • Were bypasses or drains through, which waste may inadvertently be released directly to the environment, avoided in the design of the radioactive liquid waste treatment system?	X		DOE-HDBK-1132-99, 2.8.2
49	Have provisions been made to adjust liquid waste characteristics prior to treatment to minimize adverse chemical reactions in the	X	X	DOE-HDBK-1132-99, 2.8.2

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	treatment system?			
50	Have recirculating closed-loop cooling systems been used for facilities and equipment associated with the storage or treatment of high-heat, high-level radioactive liquid waste?	X		DOE-HDBK-1132-99, 2.8.2
51	Have provisions been made for the continuous monitoring and recording of radioactivity, flow volume, pH, and other parameters required for material control and proper waste treatment operations while each volume of industrial waste is being received by an on-site treatment plant?	X	X	DOE-HDBK-1132-99, 2.8.2
52	Are liquid process wastes, containing radioactive or other hazardous material, collected and monitored near the source of generation before batch transfer through appropriate pipelines or tank transfer to a liquid waste treatment plant or area? Are radiation, liquid level, or conductivity detectors provided in collection systems?	X		DOE-HDBK-1132-99, 2.8.2
53	Do effluent system designs preclude the holdup or collection of fissile material or other material capable of sustaining a chain reaction in portions of the system that are not geometrically favorable? Was nuclear criticality safety considered in the design of airborne effluent systems?	X		DOE-HDBK-1132-99, 2.8.2
54	Have provisions been made to handle combustible gasses generated during waste handling and/or storage?	X		DOE-HDBK-1132-99, 2.8.2
55	Has consideration been given to condensation and deposition of aerosols formed in vent lines?	X		DOE-HDBK-1132-99, 2.8.2
56	Has cooling water systems or cooling air systems been provided, where required, for facilities and equipment associated with the interim storage or treatment of high-level radioactive solid waste, and to maintain the long-term integrity of the primary confinement boundary? To the extent practical, has passive cooling means been used for air cooling systems?	X		DOE-HDBK-1132-99, 2.9.2
57	Have instrumentation and control systems been required at a Radioactive Solid Waste Facility to provide monitoring and control capabilities associated with confinement, nuclear criticality	X		DOE-HDBK-1132-99, 2.9.2

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	safety, and radiation protection?			
LOIs Related to Policies and Requirements				
58	Was the occupational RPP developed in an integrated manner addressing regulations and Orders, including 10 CFR 835 and DOE O 458.1?		X	• 10 CFR 835.101 • DOE O 458.1
59	Has the contractor RPP been approved by DOE as required by 10 CRF 835.101(a)?		X	10 CFR 835.101(a)
60	Has the operating contractor established formal documentation defining clear lines of authority and responsibility for management of the occupational radiation protection program?		X	DOE-STD-1098, 141
61	Have the responsibilities of each staff position been defined for radiation protection activities?		X	DOE-STD-1098, 143
LOIs Related to Radiological Protection Program Implementation				
62	Are internal audits performed by a documented and established process that addresses all of the program elements, including examination of program content and implementation such that all elements are reviewed no less frequently than every 36 months?		X	• 10 CFR 835.102 • DOE G 441.1-1C, 3.0 • DOE-STD-1098, 134
63	Do individuals responsible for developing and implementing elements of the RPP have the education, training and skills required to adequately perform their assigned tasks?		X	• 10 CFR 835.103 • DOE G 441.1-1C 3.2.2 • DOE-STD-1098, 612
64	Have written procedures been developed and implemented as necessary to ensure compliance with 10 CFR 835 and the contractor RPP?		X	• 10 CFR 835.104 • DOE G 441.1-1C 3.2.0
65	Have procedures been developed commensurate with the radiological hazards created by the activity and consistent with the education, training, and skills of the individuals exposed to those hazards?		X	• 10 CFR 835.104 • DOE G 441.1-1C 3.2.0
66	Has the operating contractor fully integrated its occupational radiation protection program into their work planning and execution process?		X	• 10 CFR 835.501(5)(d) • DOE G 441.1-1C 4.2.6 • DOE-STD-1098, 311
67	Does the operating contractor's Safety and Health Organization have a system in place to control and maintain current occupational		X	DOE O 422.1, 2.p

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	radiation protection procedures and guides?			
68	Does the contractor's procedure control system include a mechanism for updating and distributing procedures, and internal guides on a specified schedule – including radiological procedures?		X	DOE O 422.1, 2.p
69	Does the operating contractor's Safety and Health Organization perform analyses on significant occupational radiation protection assessment findings?		X	DOE-STD-1098, 134
70	Has the operating contractor identified personnel responsible for correcting occupational radiation protection deficiencies?		X	DOE-STD-1098, 141
71	Have the actions necessary to correct radiation protection deficiencies been addressed and a schedule for implementing corrective actions been established?		X	DOE-STD-1098, 134
72	• Does the operating contractor's Safety and Health Organization perform trend analysis of findings from the occupational radiation protection program? • Are identifiable trends communicated to the DOE Field Element? • Are corrective actions identified and mutual agreement reached with the field office for resolution of significant deficiencies?		X	Good Practice
73	Does the operating contractor's Safety and Health Organization have a tracking system that includes all occupational radiation protection findings?		X	Good Practice
74	• Does the contractor's tracking system identify corrective actions, schedules, and progress made on corrective actions? • Is other information such as results of root cause analyses included in the tracking system? • Is there a method to flag or highlight significant events or actions included in the tracking system?		X	DOE-STD-1098, 134
75	• Does the operating contractor's Safety and Health Organization ensure that management processes, activity hazards identification and analysis, and functional technical appraisals in specific occupational		X	• 10 CFR 835.501(d) • DOE-STD-1098, 311 • DOE G 441.1-1C, 4.2.6

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	radiation protection subject areas are included in the contractor's program and are integrated into the contractor's safety management, work planning and execution system? • Does it include items such as: activity hazards analysis, exposure assessments, hazard controls and, the specific technical program elements (e.g., ALARA, training, internal exposure, external exposure, posting, labeling, access control, work control, instrumentation, records, reports)?			
76	Does the operating contractor have an effective corrective action program and organizational structure for resolving related action items?		X	Good Practice
77	Does the operating contractor's Safety and Health Organization have an adequate staff with a level of professional training, and experience commensurate with the requirements for implementation of the occupational radiation protection program?		X	DOE-STD-1098, 143
78	• Is the operating contractor's occupational radiation protection assessment staff adequately trained in occupational radiation protection assessment and does their training addresses familiarization with all mandatory regulations, DOE/ANSI standards, guidance documents, and other references that are pertinent to the technical area? • Are procedures and instructions used for conducting the assessment and for preparing reports and related documentation?		X	• 10 CFR 835.103 • DOE-STD-1098, 654 • DOE G 441.1-1C, 3.2.2
79	Does the operating contractor's Occupational Radiation Protection Organization prepare performance indicator reports, utilizing performance indicators involving occupational radiation exposures, and other operations information?		X	DOE-STD-1098, 133
80	Do performance indicators include; radiation exposure monitoring, NTS reports, ORPS reportable occurrences, and perform trending and analysis to provide early identification of potential exposure hazards and/or deteriorating/improving occupational radiation protection conditions?		X	DOE-STD-1098, 133

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
81	Does the operating contractor provide management periodic summaries of performance on the assessment and management of occupational radiation protection hazards?		X	DOE-STD-1098, 133
82	Has the operating contractor developed program management goals related to occupational radiation protection hazards?		X	DOE-STD-1098, 131
83	Are the radiation protection program (RPP) goals measurable and do they include short-term (annual) and long-term goals (several year period) to assess and manage occupational radiation protection hazards?		X	DOE-STD-1098, 132
84	Is progress towards RPP goals monitored regularly and are these goals adjusted as necessary?		X	DOE-STD-1098, 132
85	Do line managers have RPP performance elements in their personnel appraisal relating to successful attainment of program management goals?		X	Good Practice
86	Does the operating contractor have an effective personnel dosimetry and dose assessment program?		X	• 10 CFR 835, Subpart C • 10 CFR 835.401(a)(6), 402, 1304 • DOE G 441.1-1C, 6.0 • DOE-STD-1098, 211
87	Does the operating contractor have an effective portable and fixed instrumentation program including maintenance and calibration of instrumentation?		X	• 10 CFR 835.401(b) • DOE G 441.1-1C, 10.7.1 • DOE-STD-1098, 562
88	Does the operating contractor have an effective contamination control program?		X	• 10 CFR 835.1101, 1102 • DOE G 441.1-1C, 11.2 • DOE-STD-1098, 222
89	Does the operating contractor have an effective radiological monitoring program, for both area and item monitoring?		X	• 10 CFR 835.401, 403, 405 • DOE G 441.1-1C, 6.3, 6.4 • DOE-STD-1098, 551
90	Does the operating contractor have an effective		X	• 10 CFR 835.101(c),

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	ALARA program?			1001, 1002, 1003 • DOE G 441.1-1C, 4.0 • DOE-STD-1098, 117
91	Does the operating contractor have a program for evaluating and controlling exposures received under accident and emergency conditions?		X	10 CFR 835.1301, 1302
92	Does the operating contractor have an effective radioactive material control program, including sealed radioactive source control and material release?		X	• 10 CFR 835.1201, 1202, 1101 • DOE G 441.1-1C, 15.0 • DOE-STD-1098, 411
93	Does the operating contractor have an effective entry control program?		X	• 10 CFR 835 Subpart F • DOE G 441.1-1C, 11.4.1 • DOE-STD-1098, 331
94	Does the operating contractor have an effective training program for radiation safety aspects?		X	• 10 CFR 835 Subpart J • DOE G 441.1-1C, 14.1.0 • DOE-STD-1098, 611
95	Does the operating contractor have an effective posting and labeling program?		X	• 10 CFR 835 Subpart G • DOE-STD-1098, 231, 412 • DOE G 441.1-1C, 12.1
96	Does the operating contractor have an effective radiological records program?		X	• 10 CFR 835 Subpart H • DOE G 441.1-1C, 13.1 • DOE-STD-1098, 712
97	Does the operating contractor have an effective program for radiological design reviews and for administrative controls?		X	• 10 CFR 835.1001, 1002 • DOE G 441.1-1C, 4.2.5 • DOE-STD-1098, 381

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
LOIs Related to DOE Oversight Implementation				
98	Has DOE provided the operating contractor with adequate program direction guidance, standards, orders, clear priorities, and goals to facilitate meeting 10 CFR 835 requirements?		X	Good Practice
99	Does the DOE Field Element Safety and Health Organization review/follow-up on corrective actions involving occupational exposures and ensure that root causes are documented?		X	Good Practice
100	Does the DOE Field Element Safety and Health Organization independently track the findings from the contractor's audits?		X	Good Practice
101	Does the DOE Field Element Safety and Health Organization verify that the contractor has assigned qualified staff to perform internal audits of the radiation protection program?		X	Good Practice
102	Does the DOE Field Element Safety and Health Organization verify that contractor audit personnel are adequately trained to perform their duties related to occupational exposures?		X	Good Practice
103	Has the DOE Field Element verified that training includes conduct of audits and overview of procedures as well as training to ensure technical expertise?		X	Good Practice
104	Does the DOE Field Element review corrective action plans related to occupational radiation protection program deficiencies to ensure they address all findings, issues, and root causes?		X	Good Practice
105	Has the DOE Field Element Safety and Health Organization verified that the contractor has ensured that management processes, activity hazards identification and analysis, and functional technical appraisals in specific subject areas are included in the contractor's program and are integrated into the contractor's safety management, work planning, and execution system?		X	Good Practice
106	Does the DOE Field Element Safety and Health Organization verification include conducting independent review or sampling of the contractor's: • management concerns (e.g., policy, directives, organization, communication, operating procedures, coordination, staffing		X	Good Practice

LOI Set 9: Radiation Protection.				
	Radiation Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	and professional development, facilities, equipment, and support, budget review, accident/incident investigation, performance analysis, and quality assurance), • activity hazards analysis, • exposure assessments, • hazard controls and, • specific technical program elements (e.g., ALARA, training, internal exposure, external exposure, posting, labeling, access control, work control, instrumentation, records, reports)?			
107	Does the DOE Safety and Health Organization conduct technical appraisals of operating contractor's radiation protection program at least once every 3 years?		X	Good Practice
108	• Does the DOE Field Element provide effective oversight and implementation of the contractor award fee evaluation? • Does DOE also ensure that appropriate percentages are applied to the evaluation of program performance against agreed objectives and requirements? • Are the DOE Field Organization award fee determinations consistent with audit reports and self-assessments? • Are the DOE award fee determinations integrated with performance indicator reports, occurrence reports, accident, illness, injury data, corrective action plans, and closeout of findings?		X	Good Practice
109	Does the DOE Field Element have an adequate number of staff with technical skills assigned to carry out oversight of radiation protection?		X	Good Practice
110	Does the DOE Safety and Health Organization prepare an annual schedule showing the oversight of the contractor's radiation protection program planned for the following year?		X	Good Practice

LOI Set 10: Chemical

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Have all hazardous chemical materials with known or suspected toxic properties been subjected to the screening process?	X		DOE-STD-1189-2008, Appendix A
2	Have chemicals that have been excluded from further analysis for functional classification and identification of the attendant design criteria been excluded based on the following criteria: • Chemicals with no known or suspected toxic properties • Materials used in the same form, quantity, and concentration as a product packaged for distribution and use by the general public • Chemicals in a quantity that can be "easily and safely manipulated by one person." These can be determined by 29 CFR 1910.1450(b) • Materials that have a health hazard rating of 0, 1 or 2, based on NFPA 704. • Solid or liquid materials that, because of their physical form or other factors (e.g., plausible dispersal mechanisms), do not present an airborne exposure hazard • Chemicals that can be defined as a Standard Industrial Hazard for which national consensus codes and standards provide for sage design and operation. The consensus code or standard needs to be identified and must be applicable to the use of the chemical in the facility that is to be screened from further evaluation?	X		DOE-STD-1189-2008, Appendix A
3	• Have hazardous materials meeting the following requirements been analyzed: • Chemicals with an assigned health hazard rating of 3 or 4 based on NFPA 704 in quantities greater than those that can be "easily and safely manipulated by one person"? • Chemicals without assigned health	X		DOE-STD-1189-2008, Appendix A

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	hazard ratings if in quantities greater than those that can be "easily and safely manipulated by one person"?			
4	• Have the potential exposures to the public and collocated workers been compared to the following threshold values for consideration of SSC safety significant classification to prevent or mitigate these exposures: • **Public:** Exposure > AEGL-2/ERPG-2/TEEL-2 • **Collocated Worker:** Exposure > AEGL-3/ERPG-3/TEEL-3?	X		DOE-STD-1189-2008, Appendix A
5	Does the analysis and evaluation use the preferred order of AEGL, ERPG then TEEL as identified in Standard 1189?	X		DOE-STD-1189-2008, Appendix A
6	Were the potential toxicological consequences of a release based on the peak air concentration at the receptor location that can occur any time during the release?	X		DOE-STD-1189-2008, Appendix A
7	For hazardous material aerosols and gases with a density near that of air, was a standard Gaussian atmospheric dispersion used?	X		DOE-STD-1189-2008, Appendix A
8	Was the peak 15-minute, time weighted average (TWA) concentration compared to the identified threshold values for safety significant designation?	X		DOE-STD-1189-2008, Appendix A
9	If the toxic effects of the chemical are known to be dose-dependent and not concentration-dependent was the 1-hour average concentration used as appropriate?	X		DOE-STD-1189-2008, Appendix A
10	For chemical releases that involve gases that have a density substantially different from air, was the analysis performed using approved software code designed and validated to handle atmospheric dispersion for such gases?	X		DOE-STD-1189-2008, Appendix A
11	Was the unmitigated qualitative analysis of potential consequences to the facility worker used to identify candidate preventative and mitigative controls?	X		DOE-STD-1189-2008, Appendix C

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
12	For each hazardous condition evaluated for the public and collocated worker in the hazards analysis, has a qualitative evaluation of unmitigated consequences to the facility worker been performed?	X		DOE-STD-1189-2008, Appendix C
13	Did the control selection process consider safety significant SSCs for worker protection for the following conditions: • Energetic releases of high concentration of toxic chemical materials where the FW would normally be immediately present and may not be able to take self-protective measures • Deflagrations or explosions within process equipment or confinement and containment structures or vessels where serious injury or death to a FW may result • Chemical or thermal burns to a FW that could cover a significant portion of the FW body where self-protective actions are not reasonably available due to the speed of the event or where there may be no warning to the FW of the hazardous condition • Leaks from process systems where asphyxiation of a FW normally present may result?	X		DOE-STD-1189-2008, Appendix C
14	Was safety significant SSCs considered for cases involving significant exposure of the FW to hazardous materials?	X		DOE-STD-1189-2008, Appendix C
15	Did the evaluation for determination of possible safety significant SSCs consider the evaluation criteria of AEGL-3, ERPG-3 or TEEL-3?	X		DOE-STD-1189-2008, Appendix C
16	Has the facility/project implemented an Integrated Safety Management program that includes chemical/hazardous materials as required by DOE O 440.1B?		X	DOE O 440.1B
17	Does the safety SMP require routine evaluation of workplaces and activities by workers, supervisors, and managers and periodic evaluation by qualified worker protection professionals?		X	DOE O 440.1B [paragraph 4i(4)]
18	For control of chemical hazards to the		X	DOE O 440.1B

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	worker does the facility/project follow the requirements of ISMS?			
19	Does the facility/project have in industrial hygiene program implemented that addresses: (1) Initial or baseline surveys of all work areas or operations to identify and evaluate potential worker health risks. (2) Coordination with planning and design personnel to anticipate and control health hazards that proposed facilities and operations would introduce. (3) Coordination with cognizant occupational medical, environmental, health physics, and work planning professionals. (4) Policies and procedures to mitigate the risk from identified and potential occupational carcinogens. (5) Professionally and technically qualified industrial hygienists to manage and implement the industrial hygiene program. (6) Periodic resurveys and/or exposure monitoring as appropriate. (7) Documented exposure assessment for chemical, physical and biological agents and ergonomic stressors using recognized exposure assessment methodologies and use of accredited industrial hygiene laboratories. (8) Specification of appropriate engineering, administrative, work practice, and/or personal protective control methods to limit hazardous exposures to acceptable levels. (9) Worker education, training, and involvement. (10) Use of appropriate industrial hygiene standards. (11) Use of respiratory protection equipment in accordance with applicable DOE, and other requirements?		X	DOE O 440.1B
20	What is the process used to identify potentially hazardous chemicals that are used or stored in the facility? What hazard		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	analyses are conducted for such chemicals and for chemical processes in the facility? What is the "driver" for these hazard analyses?			Appendix C, Criterion 1
21	What are the qualifications of personnel performing chemical hazard analysis? Are "hands-on" employees involved in all chemical hazard analyses conducted by SMEs? Do ES&H professionals conduct walk-downs of facilities in which chemicals are to be used or stored, prior to completing the hazard analysis?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 1
22	Do the work packages reflect a well-developed planning process that incorporates potential chemical safety concerns?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 1
23	Has the facility adequately implemented a job hazard analysis procedure for work planning? Is chemical safety integrated into this process? Is identification (and reduction) of waste generation integrated into this process?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion, 1
24	Are there procedures or instructions in place to specify when review and approval are needed on project documentation to ensure that any chemical hazards management concerns are addressed?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 1
25	Does a facility-specific procedure exist to implement a comprehensive chemical hazard management program? Does it reflect site-wide requirements and all applicable standards?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 1
26	Are waste types, quantities, and their associated hazards identified in the job hazard analysis and work planning process?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 1
27	Are hazards of legacy chemicals (e.g., abandoned, residual chemicals in tanks and pipes with inadequate controls) properly identified and addressed? Have their potentially degraded storage conditions been considered? Have these chemicals been sampled and characterized? Are there adequate controls to prevent and mitigate adverse		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 1

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	consequences? Are the containers of these chemicals periodically inspected and maintained? Are the hazards of these chemicals appropriately and sufficiently addressed in the facility's safety basis?			
28	What is the regulatory status of the legacy chemicals in the facility? Has the regulatory status of the legacy chemicals as hazardous waste been appropriately determined?		X	DOE-HDBK-1139/1-2006 Appendix C, Criterion 1
29	Has pollution prevention (substitution with a non-hazardous material or reduction in quantity used) been considered, when applicable, as a way to prevent or mitigate chemical hazards?		X	DOE-HDBK-1139/1-2006 Appendix C, Criterion 1
30	Are adequate and appropriate controls for chemical hazards identified through the hazard analysis? Are adequate controls identified for all chemical hazards? Are engineered controls preferred over administrative controls? Are administrative controls preferred over personal protective equipment? Are passive controls preferred over active controls?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 1 • DOE-STD-1100-2004
31	Are hazard assessments essential to emergency response established and maintained?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 1
32	Are the responsibilities of line management for chemical safety and chemical management clearly defined, documented, and understood?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 2
33	Are the roles and responsibilities of support staff and other personnel associated with the facility's chemical management program/system clearly defined, documented, and understood? Have the primary and secondary points of contacts been identified?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 2
34	Are the roles and responsibilities of personnel providing chemical safety expertise and support properly integrated with the line management's responsibilities relative to operations?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 2
35	Who is responsible for controlling the		X	• DOE G 440.1-1B

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	hazards arising from chemical storage and use in the workplace? How are they held accountable?			• DOE-HDBK-1139/1-2006 Appendix C, Criterion 2
36	What processes are in place to ensure adequate input by ES&H and other appropriate professionals in the designation of controls for chemical hazards, and in how they are implemented?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 2
37	Are the resources needed for providing an adequate level of chemical safety and management support being communicated to the line management? Is management responsive to the resource needs and concerns identified by ES&H and other appropriate professionals?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 2
38	Do facility and warehouse control procedures properly implement chemical management procedures to ensure safe handling and storage of chemicals?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
39	Is prevention and source reduction of hazardous materials supported by appropriate procurement and inventory practices?		X	DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
40	Is the chemical inventory at a given storage location being properly updated as the inventory changes? Is the inventory inspection and surveillance conducted at an appropriate frequency? Do all chemical storage areas receive adequate coverage through periodic surveillance?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
41	Is a database or hardcopy file maintained of MSDS for chemicals used and stored at the work-site and at the facility? How is access to MSDS information provided to workers?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
42	Is there a procedure that ensures that chemicals stored in a given location are compatible? Is it adequately implemented?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
43	What criteria are used to select appropriate standards and requirements (e.g., Work Smart Standards,		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	Standards/Requirements Identification Documents, or others, as applicable) to address all chemical hazards? What are the qualifications of the individuals performing standards selection?			
44	What processes are in place to ensure adequate input by ES&H professionals in the implementation of controls for chemical hazards?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
45	What is the process for authorizing a chemical to be used on the site? What pollution prevention practices are conducted at the site? Is there a list of restricted chemicals? How is chemical storage and use policed? How are excess or waste chemicals disposed of? What processes are in place to assure chemicals are not abandoned when work on a project ceases?		X	DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
46	What means are employed to ensure that the identified controls are implemented, operable, and functioning so long as a chemical hazard is present?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
47	Is personal protective equipment required to be used for any activity involving hazardous chemicals? Has substitution of a less hazardous chemical been considered? Are engineering controls in place or planned for these operations? What other controls or measures are in place for these operations?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
48	When and how is a decision made to evaluate employee exposure to a chemical hazard? What is management's role in assuring that chemical exposures are evaluated and properly addressed?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
49	How does your occupational medicine group become aware of chemical usage and employee exposure to specific chemicals? What are their roles and responsibilities once an employee's exposure has been demonstrated?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3
50	Are changes to mission, operations, and conditions analyzed for needed changes to requirements? How are ES&H personnel involved in this process?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 3

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
51	What training is provided to employees on the hazards of chemicals and chemical processes they work with, and on the controls that are most appropriate for those hazards? How frequently is this training provided? Is this training kept current? What is the frequency of refresher training provided for affected employees? Is training effectiveness measured? If so, how?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 4
52	What training is provided to supervisors and managers on management of hazards arising from chemical storage and use?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 4
53	Are requests for assistance and documents for information or review distributed to appropriately qualified and knowledgeable staff?		X	DOE-HDBK-1139/1-2006 Appendix C, Criterion 4
54	Is chemical safety support staff sufficiently familiar with facility operations? Do they participate in routine inspections, assessments, and audits; in training and in the categorization, analysis and development of corrective actions for occurrences? Do they participate in overseeing the implementation of selected controls and in follow-up inspections of those controls?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 4
55	Are the managers, supervisors, and support staff sufficiently knowledgeable about pollution prevention and waste minimization (prevention and source reduction of hazardous materials), such that these are incorporated into their chemical hazard prevention and mitigation activities?		X	DOE-HDBK-1139/1-2006 Appendix C, Criterion 4
56	Does the organization (internal or subcontractor) responsible for providing chemical safety support use a training implementation plan to manage staff training and qualifications?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 4
57	Do position descriptions for points-of-contact or coordinators responsible for chemical hazards management appropriately reflect their duties and responsibilities relative to chemical safety,		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 4

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	as well as their training and subject matter competency?			
58	Has the facility performed an assessment and gap analysis to identify significant gaps and deficiencies in its program? Does the facility maintain an up-to-date corrective action plan? Are the action items prioritized? Have the corrective actions completed been properly closed? Are open items being pursued according to their priority?		X	DOE-HDBK-1139/1-2006 Appendix C, Criterion 5
59	Do post-job critiques and reviews reveal that chemical safety concerns were adequately handled, or if identified, adequately pursued and resolved? Is there evidence showing that lessons learned are properly used to improve work conditions or performance?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 5
60	Are assessment results communicated to senior management for their use in making informed determinations? Do managers routinely use feedback tools, such as performance indicators, reviews, debriefs, and lessons learned?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 5
61	Are occurrence reports evaluated for applicability and communicated to the right individuals?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 5
62	Are suggestions of employees and other professionals used to improve performance?		X	• DOE G 440.1-1B • DOE-HDBK-1139/1-2006 Appendix C, Criterion 5
63	Are hazards associated with all activities involving chemicals that could put the employee at risk of injury or illness evaluated? Those activities include, but are not limited to a) design of new facilities or modification of existing facilities and equipment, b) operations and procedures and c) equipment, products and services that are selected or purchased. [NOTE: Numerous other substance-specific hazard analysis requirements can be found in 29 CFR 1910, Subpart Z.]	X	X	• DOE O 440.1B; • DOE G 440.1-1B; • ANSI Z49.1, 3.2.2.2; • CGA P-1, 4.1; • NFPA 30, 5.2; • NFPA 45, 7.1; • NFPA 45, 7.2.1.1, • NFPA 430, 2.-1.1; • NFPA 432, 4.7.1; • 10 Code of Federal Regulations • (CFR) 835.204(d)(2);

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
				• 10CFR 851.21; • 29 CFR 1910.106(e)(8); • 29 CFR 1910.146(c)(1)-(d)(2); • 29 CFR 1910.1450(e)(3); • 48 CFR 970.5204-2(c)(2)11
64	Are the results of the hazard analysis documented and approved by the appropriate safety official or manager?	X	X	• 10CFR 851.26; • NFPA 430, 2.1.1; • NFPA 430, 2.10.1; • NFPA 432, 4.7.1; • 29 CFR 1910.132(d)(2)
65	Before beginning work, are employees informed of the hazards present in their work area?		X	• DOE O 440.1B; • DOE G 440.1-1B; • ANSI Z49.1, 3.2.1.2; • ANSI Z49.1, 3.2.1.3; • ANSI Z49.1, 3.2.1.5; • CGA P-1, 4.1; • NFPA 45, 7. 1; • NFPA 430, 2.7.1; • NFPA 432, 4.2; • 29 CFR 1910.1200(h)(1); • 29 CFR 1910.1450(f)(1) and • (f)(4)(i)(B) and (f)(4)(i)(C); • 29 CFR 1926.21(b)(2)
66	Have hazardous processes been analyzed for possible natural and man-made events that could lead to or result in a loss of control of hazardous material?	X	X	• DOE O 440.1B; • DOE G 440.1-1B; • DOE O 151.1C, Attachment, • Chap. IV, 3(a)(1): Attachment 2 • (CRD), sec. 3b(1); • DOE O 420.1B, II.3.b(5) • 10 CFR 830, Subpart B; • 10 CFR 850.21(a); • 10 CFR 1021.400; • 29 CFR 1910.119(e);

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
				• 29 CFR1910.120(c)(1); • 40 CFR 68.50; • 40 CFR 68.67(a); • 40 CFR 1502.14
67	Were the hazard analysis techniques selected and used appropriate for the hazards and complexities of work processes being analyzed?	X	X	• DOE O 440.1B; • DOE G 440.1-1B ; • DOE O 151.1C, CRD, 3b(1); • DOE-STD-1120-2004; • DOE-STD-3009-94; • DOE-STD-3011-94; • DOE-STD-3016-99; • DOE O 460.1B' • 10 CFR 830.7; • 10 CFR 830 Subpart B, 204(a) and (b); • 29 CFR 1910.119(e)(2); • 40 CFR 68.67(b); • 40 CFR 1502.24
68	Has process information relevant to the hazard analysis, such as energy sources and hazardous materials, been identified?	X	X	• DOE O 440.1B; • DOE G 440.1-1B; • DOE-STD-1027-92; • 10 CFR 830 Subpart B, Part • 202(b)(3); • 29 CFR 1910.119(d); • 29 CFR 1910.120(c)(3); • 40 CFR 68.65; • 40 CFR 1502.15
69	Have the consequences of postulated accidents associated with hazardous processes and their likelihood of occurrence been evaluated?	X	X	• DOE O 440.1B; • DOE G 440.1-1B; • DOE O 151.1C, CRD, 3b(1); • 10 CFR 830.204(b)(3); • 29 CFR 1910.119(e)(3); • 29 CFR 1910.120(c)(7); • 40 CFR 68.22;

LOI Set 10: Chemical				
	Chemical Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
				• 40 CFR 68.25; • 40 CFR 68.28; • 40 CFR 68.67(c); • 40 CFR 1502.16; • 40 CFR 1508.8
70	Did qualified personnel perform the hazards analyses?	X	X	• 10 CFR 850.21(b); • 29 CFR 1910.119(e)(4); • 40 CFR 68.67(d)
71	Have the results of hazard analyses been documented and approved by appropriate management?	X	X	• 10 CFR 1021.310; • 10 CFR 830 Subpart B, 204(a) and (b); • 29 CFR 1910.119(e)(5); • 29 CFR 1910.120(b)(4); • 40 CFR 68.39; • 40 CFR 68.67(e); • 40 CFR 1508.10
72	Are hazard analyses updated and revalidated periodically?	X	X	• DOE O 440.1B; • DOE G 440.1-1B; • DOE O 151.1C, Ch IV, 3a(3): • Attachment 2 (CRD), sec. • 3b(1)(d) • 10 CFR 830 Subpart B, • 204(c)(1) and (c)(2); • 29 CFR 1910.119(e)(6); • 40 CFR 68.67(f)
73	Are hazard analysis results and documentation, including updates, retained for the life of the process operation?	X	X	• DOE O 440.1B; • DOE G 440.1-1B; • 10 CFR 830.6; • 29 CFR 1910.119(e)(7); • 40 CFR 68.67(g)

LOI Set 11: Hazardous Materials

LOI Set 11: Hazardous Materials.				
	Hazardous Materials Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Does the contractor have an adequate process safety management system in place for highly hazardous material?	X	X	• 29 CFR 1926.64 • 29 CFR 1910.119 • 10 CFR 851.23(3)(7)
2	Does the contractor have an effective HAZWOPER program?	X	X	• 29 CFR 1926.65 • 29 CFR 1910.120 • 10 CFR 851.23(3)(7)
3	Does the contractor have an effective hazard communication program?	X	X	• 29 CFR 1910.1200 • 10 CFR 851.23(3) • DOE-HDBK-1139/2, 5.2.1
4	Does the contractor have an effective and fully implemented Chronic Beryllium Disease Prevention Program?	X	X	10 CFR 850
5	• Does the facility design accommodate the requirements for safeguards and security, emergency egress, and area access control for worker protection? • If these requirements appear to conflict, does life safety take precedence? • Are provisions for re-entry controlled in accordance with the RCRA for hazardous waste treatment, storage, and disposal facilities, and by 29 CFR 1910 and 1926 (OSHA) for hazardous material locations within operating facilities and construction sites?	X	X	• 29 CFR 1910.120 • 29 CFR 1926.65 • 10 CFR 851 • DOE G 420.1-1, 3.4.2
6	Does the design of engineered controls for hazardous material protection comply with requirements contained in 29 CFR 1910, Subparts G, H, and Z?	X	X	• 29 CFR 1910 • 10 CFR 851.23(3) • DOE G 420.1-1, 4.3.2
7	Where ventilation is used to control worker exposures, is it adequate to reduce the hazardous material concentrations of air contaminants to the degree that the hazardous material no longer poses a health risk to the worker (i.e., concentrations at or below the permissible exposure limits)?	X	X	• 29 CFR 1910.94 • DOE G 420.1-1, 4.3.3
8	Do air flow and other design requirements for specific types of systems comply with 29 CFR 1910, Subparts G and H?	X	X	• 29 CFR 1910, Subpart G, H

LOI Set 11: Hazardous Materials.				
	Hazardous Materials Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
				• DOE G 420.1-1, 4.3.3
9	Are requirements provided for monitoring and alarm systems for facilities that manage or use specific hazardous materials as described in 29 CFR 1910, Subpart Z? **Note:** Additional guidance on design of ventilation systems for hazardous material protection is provided in ANSI Z9.2 and ASHRAE 62.	X	X	• 29 CFR 1910, Subpart Z • DOE G 420.1-1, 4.3.3
10	Are decontamination facilities, safety showers, and eyewashes to mitigate external exposures to hazardous materials provided where mandated by 29 CFR 1910, Subparts H and Z? Are these systems designed in accordance with the requirements of ANSI Z358.1 and ANSI Z124.2?	X	X	• 29 CFR 1910, Subpart H, Z • DOE G 420.1-1, 4.3.3
11	Does the design support the primary objective of reducing the frequency, severity, and cost of incidents involving hazardous material, as well as the cost of hazardous operations? Are prevention practices, such as substitution of less hazardous materials in a project or design of a process to reduce generation of hazardous waste, examined prior to consideration of protection strategies?	X	X	DOE-STD-1189, 7.10
12	Have major hazardous materials, typically associated with process requirements, been identified and considered within the safety strategy?	X	X	DOE-STD-1189, 7.10
13	Have provisions for facility monitoring and protection instrumentation for worker protection been considered?	X	X	DOE-STD-1189, 7.10
14	Have the type and level of hazards been determined for each functional area, the attendant degree of risk established, and the possibility of cross contamination? Wherever possible, have work areas with compatible contaminants been located together to simplify design criteria related to air supply and exhaust, waste disposal, decontamination, and cross contamination?	X		• DOE G 420.1-1, 3.4 • DOE-HDBK-1132-99, 2.12.1
15	Were radioactive and hazardous material contamination control requirements considered in the design to minimize the potential for contamination spread?	X		DOE G 420.1-1, 3.4

LOI Set 11: Hazardous Materials.				
	Hazardous Materials Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
16	Have office areas been located in common-use facilities (e.g., data computation and processing, word processing, etc.) and away from process areas to minimize risks to workers of exposure to radioactive and/or hazardous materials?	X		DOE G 420.1-1, 3.4
17	Does the building layout provide protection from the hazards associated with handling, processing, and storing of radioactive and/or hazardous materials?	X		DOE G 420.1-1, 3.4.1
18	Does the arrangement and location of hazardous process equipment and its maintenance provisions provide appropriate protective and safety measures as applicable?	X		DOE G 420.1-1, 3.4.1
19	Does the facility layout provide specific control and isolation, if possible, of quantities of flammable, toxic, and explosive gases, chemicals, and other hazardous materials admitted to the facility?	X		DOE G 420.1-1, 3.4.1
20	Does the design facilitate deactivation by incorporating facility features that aid in the removal of surplus radioactive and chemical materials; storage tank cleanout and maintenance; stabilization of contamination and process materials; and the removal of hazardous, mixed, and radioactive wastes?	X	X	• DOE G 420.1-1, 3.7.1 • DOE-HDBK-1132-99, 2.12.2
21	• Does the facility design incorporate measures to simplify decontamination of areas that may become contaminated with radioactive or hazardous materials? • Are items such as service piping, conduits, and ductwork kept to a minimum in potential contamination areas and arranged to facilitate decontamination? • Are walls, ceilings, and floors in areas vulnerable to contamination finished with washable or strippable coverings? • Are metal liners used in areas that have the potential to become highly contaminated? • Are cracks, crevices, and joints filled and finished smooth to prevent accumulation of contaminated material? • Does the facility design incorporate features that will facilitate decontamination to achieve facility decommissioning, to	X		• DOE G 420.1-1, 3.7.2 • DOE-HDBK-1132-99, 2.12.1

LOI Set 11: Hazardous Materials.				
	Hazardous Materials Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	increase the potential for other uses, or both?			
22	Are localized liquid-transfer systems with emphasis on localized batch solidification of liquid waste to avoid long runs of buried contaminated piping used? Are special provisions included in the design to ensure the integrity of joints in buried pipelines?	X		• DOE G 420.1-1, 3.7.3 • DOE-HDBK-1132-99, 2.12.2
23	Are the exhaust filtration components of the ventilation systems located at or near individual enclosures to minimize long runs of internally contaminated ductwork?	X		• DOE G 420.1-1, 3.7.3 • DOE-HDBK-1132-99, 2.12.3
24	Does the design include equipment (including effluent decontamination equipment) that precludes, to the extent practicable, the accumulation of radioactive or other hazardous materials in relatively inaccessible areas, including curves and turns in piping and ductwork? **Note:** Accessible, removable covers for inspection and cleanouts are encouraged.	X		• DOE G 420.1-1, 3.7.3 • DOE-HDBK-1132-99, 2.12.2
25	Are there provisions for flushing and/or cleaning contaminated or potentially contaminated piping systems?	X		DOE G 420.1-1, 3.7.3
26	Do piping systems that carry contaminated or potentially contaminated liquid free drain via gravity?	X		DOE G 420.1-1, 3.7.3
27	Does the design ensure that respirators are not required for normal operating conditions or routine maintenance activities except as a precautionary measure?	X	X	DOE G 420.1-1, 4.3.3
28	Do ventilation systems for hazardous material protection use exhaust hoods to control concentrations of hazardous materials from discrete sources, or control the number of air changes per hour for an entire room or bay?	X	X	DOE G 420.1-1, 4.3.3
29	Does the design minimize hazardous material exposure to personnel, both external and internal, and provide adequate monitoring and notification capabilities to inform workers of unsafe conditions?	X	X	DOE G 420.1-1, 4.3.4
30	Does the design provide hazardous material protection through: remote handling, area and equipment layout, spill-control features,	X	X	DOE G 420.1-1, 4.3.4

LOI Set 11: Hazardous Materials.				
	Hazardous Materials Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	confinement, ventilation, etc.?			
31	Does the design preclude occupied spaces where low oxygen content or air displacement may occur or where reactive, combustible, flammable, or explosive gas, vapor, or liquid accumulation might occur?	X	X	DOE G 420.1-1, 4.3.4
32	Does the design include safety controls and features that consider contaminant chemical forms and minimize the potential for inhalation and contact under all conditions?	X	X	DOE G 420.1-1, 4.3.4
33	Does the design include directed ventilation flow paths to move contaminants away from worker breathing zones?	X	X	DOE G 420.1-1, 4.3.4
34	Does the design ensure that ventilation flow will cascade from clean areas to contaminated areas to preclude contamination spread?	X	X	DOE G 420.1-1, 4.3.4
35	Does the design provide for uniform distribution of incoming air and/or air mixing equipment to ensure that no pockets of stagnant air exist in areas where workers are present?	X	X	DOE G 420.1-1, 4.3.4
36	Do safety-significant and safety-class ventilation system designs include adequate instrumentation to monitor and assess performance with necessary alarms for annunciation of abnormal or unacceptable operation?	X	X	DOE G 420.1-1. 5.2.2.1
37	Have manual or automatic protective control features been provided to prevent or mitigate an uncontrolled release of radioactive and/or hazardous material to the environment and to minimize the spread of contamination within the facility?	X	X	DOE G 420.1-1. 5.2.2.1
38	Have vent streams potentially containing significant concentrations of radioactive and/or hazardous materials been processed through an off-gas cleanup system before being exhausted to the environment?	X	X	DOE G 420.1-1. 5.2.2.1
39	Are cleanup systems designed to remove particulates and noxious chemicals?	X	X	DOE G 420.1-1. 5.2.2.1
	Is the design of safety-significant and safety-class off-gas systems commensurate with the sources and characteristics of the radioactive and chemical components of the off-gas air	X	X	DOE G 420.1-1. 5.2.2.1

LOI Set 11: Hazardous Materials.				
	Hazardous Materials Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	stream to prevent or mitigate the uncontrolled releases of radioactive and/or hazardous materials to the environment?			
40	Have process hazards identification and analysis, job hazards identification and analysis, and workplace hazard identification and analysis for safety and environmental concerns been conducted by specialists conducting walkthroughs, employee and supervisor training, safety meetings, or combinations thereof? **Note:** These efforts should help identify the hazards associated with the process, activity, or substance and define the necessary controls to protect the worker, the public, and the environment.		X	DOE-HDBK-1139/2, 5.2.1
41	Have appropriate safety basis documentation been developed for both nuclear and non-nuclear facilities using a graded approach to characterize the chemical hazards?		X	DOE-HDBK-1139/2, 5.2.1
42	Is a formal Management of Change process in place for the developed safety basis documents?		X	DOE-HDBK-1139/2, 5.2.1
43	Does the program for identifying and analyzing chemical hazards include: a description of the process, job, or experiment; chemical information related to the function; and any laboratory experiment that enables associated hazards to be identified and understood?		X	DOE-HDBK-1139/2, 5.2.1
44	Do safety reviews include pre-startup hazard reviews for new or modified facilities, processes, or laboratory experiments?	X	X	DOE-HDBK-1139/2, 5.2.1
45	Has safety documentation been reviewed at prescribed frequencies and updated, as necessary, to identify and account for the following events: • significant changes in the process; • availability of new chemical hazard information; • changes in process chemicals (including physical form, purity, major impurities); • inventory changes; • or facility modifications?		X	DOE-HDBK-1139/2, 5.2.1

LOI Set 12: Sustainability

LOI Set 12: Sustainability.				
	Sustainability Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Have the High Performance and Sustainable Building (HPSB) principles been applied in accordance with Executive Order 13423, Section 2(f), to the siting, design, construction, and commissioning of new facilities and major renovations of existing facilities?	X		• DOE O 413.3B, Attachment 1, Contract Requirements Document, Requirement 14 • DOE O 436.1, Requirement 4.a
2	Have the new construction or major building renovations meet the U.S. Green Building Council's LEED Gold certification absent an approved waiver from the Acquisition Executive?	X		DOE O 413.3B, Attachment 1, Contract Requirements Document, Requirement 14
Critical Decision-1 Requirements and Guidance				
3	Has the project integrated the HPSB principles into key project documents, including the Conceptual Design Report, Project Execution Plan, and Acquisition Strategy? Has the project integrated the HPSB principles into alternative selection and cost estimates?	X		• DOE O 413.3B, Appendix C, Table 2.1 CD-1 Requirements • DOE G 413.3-6, Section 6
4	Are there LEED accredited professionals on the Federal Integrated Project Team?	X		DOE G 413.3-6, Section 6
5	Are there LEED accredited professionals on the contractor's project team?			DOE G 413.3-6, Section 6
6	Does the project use a sustainability assessment tool based on the LEED rating system to certify the project's conformance with the HPSB principles? **Note: I**f no, justification needs to be provided for not using the LEED rating system.	X		DOE G 413.3-6, Section 6
7	What is the potential LEED rating and HPSB score for the project as defined in DOE G 413.3-6, Attachment B, and Table B-1?	X		DOE G 413.3-6, Section 6
8	Did the project prepare a sustainable design report? **Note:** If not, does the Conceptual Design Report describe the sustainable features of the design?	X		DOE G 413.3-6, Section 6
9	Does the project follow the Whole Building Design concepts in implementing the Executive Order 13423's sustainable building	X		DOE G 413.3-6, Section 6

LOI Set 12: Sustainability.				
	Sustainability Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	requirements and HPSB principles?			
10	If the decision is to exempt the project from all or some of the HPSB Principles, has the exemption decision and rational been documented and who made the decision?	X		DOE G 413.3-6, Section 6
11	Has the HPSB requirements incorporated into the Contract?	X		DOE G 413.3-6, Section 6
12	Has the project registered with the US Green Building Council as a DOE project after it has reached the certification level?	X		DOE G 413.3-6, Section 6
Critical Decision-2 Requirements and Guidance				
13	Prior to CD-2, have the sustainable design principles been incorporated into the preliminary design and design review?	X		• DOE O 413.3B, Appendix C, Table 2.2 CD-2 Requirements • DOE G 413.3-6, Section 7
14	For preliminary design, has the project decided which sustainable building features can be achieved, based on design tradeoffs between desired features, cost, safety and environmental concerns?	X		DOE G 413.3-6, Section 7
15	Can the project achieve the intended LEED rating level?	X		DOE G 413.3-6, Section 7
16	Is the documentation updated to support the LEED rating level certification?	X		DOE G 413.3-6, Section 7
17	Has the sustainable design report been updated, or the Preliminary Design Report been developed to include the discussion of the sustainable design features?	X		DOE G 413.3-6, Section 7
Critical Decision-3 Requirements and Guidance				
18	Prior to CD-3, have the HPSB design principles been incorporated into the Final Design and the External Independent Review?	X		• DOE O 413.3B, Appendix C, Table 2.3 CD-3 Requirements • DOE G 413.3-6, Section 8
19	Prior to project closeout, have the achievement of Facility Sustainment goals been completed and documented by an independent third-party entity within one year of facility occupancy?	X		DOE O 413.3B, Appendix C, Table 2.5 Project Closeout Requirements
20	For final design, has the project decided which sustainable building features can be further achieved based on design tradeoffs between	X		DOE G 413.3-6, Section 8

LOI Set 12: Sustainability.				
	Sustainability Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	desired features, cost, safety and environmental concerns?			
21	Can the project achieve the intended LEED rating level?	X		DOE G 413.3-6, Section 8
22	Prior to construction, has the project identified the HPSB-related specifications, such as procurement and use of environmentally preferable materials?	X		
23	Has the sustainable design report been updated, or the Final Design Report been developed to include the discussion of the sustainable design features?	X		
24	Are commissioning requirements related to HPSB identified in the construction documents?	X		
25	Have the final design review and construction readiness review confirm that the HPSB design features are final, been procured, and procedures exist/or being developed for their construction and installation?	X		
Critical Decision-4 and Project Closeout Requirements and Guidance				
26	Has a Checkout, Testing, and Commissioning Plan been prepared?	X		DOE G 413.3-6, Section 9
27	Does the Plan include the testing of HPSB structures, systems, and components to ensure they perform as designed and are optimized for energy efficiency, resource conservation, and occupant satisfaction?	X		DOE G 413.3-6, Section 9
28	Prior to project closeout, have the achievement of Facility Sustainment goals been completed and documented by an independent third-party entity within one year of facility occupancy?	X		DOE O 413.3B, Appendix C, Table 2.5 Project Closeout Requirements
HPSB Guiding Principle I -- Employ Integrated Design Principles				
29	Does the project use a collaborative, integrated planning and design process?	X		DOE G 413.3-6, Attachment A, Section I
30	Does the project have an integrated project team beginning at CD-1 and continuing through CD-4?	X		DOE G 413.3-6, Attachment A, Section I
31	Does the project establish performance goals for siting, energy, water, materials, and indoor environmental quality along with other design goals?	X		DOE G 413.3-6, Attachment A, Section I

LOI Set 12: Sustainability.				
	Sustainability Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
32	Does the project strategy ensure the incorporation of these design goals through conceptual, preliminary, and final design?	X		DOE G 413.3-6, Attachment A, Section I
33	Does the HPSB design concepts take into account all phases of the facility life cycle, including eventual decommissioning?	X	X	DOE G 413.3-6, Attachment A, Section I
34	Is commissioning under the LEED framework considered as part of the integrated design principles?	X		DOE G 413.3-6, Attachment A, Section I
35	Are commissioning practices as defined under the LEED framework tailored to the size and complexity of the building and its system components in order to verify their performance and help ensure the design requirements are met?	X		DOE G 413.3-6, Attachment A, Section I
36	Is there a designated LEED commissioning authority as defined under the LEED framework to oversee the commissioning activities and documentation preparations?	X		DOE G 413.3-6, Attachment A, Section I
HPSB Guiding Principle II -- Optimize Energy Performance				
37	Does the project/facility have an energy efficiency program?	X	X	DOE G 413.3-6, Attachment A, Section II
38	Has the project/facility established a whole building performance target that takes into account the intended use, occupancy, operations, plug loads, other energy demands, and design to earn the Energy Star targets for new construction and major renovation where applicable?	X	X	DOE G 413.3-6, Attachment A, Section II
39	For new construction project, has a goal been established to reduce the energy cost budget by 30% compared to the baseline building performance rating established by industry standards, including ANSI, ASHRAE, and Illuminating Engineering Society of North America (IESNA)?	X		DOE G 413.3-6, Attachment A, Section II
40	For major renovations, has a goal been established to reduce the energy cost by 20% below pre-renovations 2003 baseline?		X	DOE G 413.3-6, Attachment A, Section II
41	Does the project/facility have an on-site renewable energy program?	X	X	DOE G 413.3-6, Attachment A, Section II
42	Has the project/facility established a goal of meeting 30% of the hot water demand through the installation of solar hot water heaters,	X	X	DOE G 413.3-6, Attachment A, Section II

LOI Set 12: Sustainability.				
	Sustainability Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	when lifecycle cost effective, as required by the EISA Section 523?			
43	Has the project/facility implemented renewable energy generation projects, when lifecycle cost effective, as required by EO 13423?	X	X	DOE G 413.3-6, Attachment A, Section II
44	Does the project/facility have an energy measurement and verification program?	X	X	DOE G 413.3-6, Attachment A, Section II
45	Has the project/facility installed building level electricity meters in new construction and renovation projects to track and continuously optimized performance, as required by Energy Act of 2005 Section 103?	X	X	DOE G 413.3-6, Attachment A, Section II
46	Has the project/facility installed meters for natural gas and steam, if applicable, as required by EISA Section 434?	X	X	DOE G 413.3-6, Attachment A, Section II
47	Does the project/facility have an energy benchmarking program?	X	X	DOE G 413.3-6, Attachment A, Section II
48	Has the project/facility established a benchmarking program to compare actual performance data from the first year of operation with the energy design target?	X	X	DOE G 413.3-6, Attachment A, Section II
49	Does the project/facility encourage the development and use of grid-source, renewable energy technologies on a net zero pollution bases?	X	X	DOE G 413.3-6, Attachment A, Section II
HPSB Guiding Principle III -- Protect and Conserve Water				
50	Does the project/facility have an indoor water protection and conservation program?	X	X	DOE G 413.3-6, Attachment A, Section III
51	Has the project/facility established a strategy that in aggregate use a minimum of 20% less potable water than the indoor water use baseline calculated for the building, after meeting the Energy Policy Act of 1992, Uniform Plumbing Codes 2006, and the international Plumbing Codes 2006 fixture performance requirements?	X	X	DOE G 413.3-6, Attachment A, Section III
52	Does the project/facility have an outdoor water protection and conservation program?	X	X	DOE G 413.3-6, Attachment A, Section III
53	Has the project/facility employed outdoor water efficient landscape and irrigation strategies for reducing outdoor potable water use by a minimum of 50% over that consumed by conventional means (plant species and	X	X	DOE G 413.3-6, Attachment A, Section III

LOI Set 12: Sustainability.				
	Sustainability Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	plant densities)?			
54	Has the project established design and construction strategies that reduce storm water runoff and polluted site water runoff?	X		DOE G 413.3-6, Attachment A, Section III
55	Has the project/facility installed water meters for locations with significant outdoor water use?	X	X	DOE G 413.3-6, Attachment A, Section III
56	Does the project/facility have a water processing program?	X	X	DOE G 413.3-6, Attachment A, Section III
57	Has the project/facility established a lifecycle cost effective water conservation measures program for processing potable water to improve building's energy efficiency, as required by Energy Policy Act of 2005, Section 109?	X	X	DOE G 413.3-6, Attachment A, Section III
58	Does the project/facility use water-efficient products?	X	X	DOE G 413.3-6, Attachment A, Section III
59	Does the project/facility specify the use of EPA's Water Sense-labeled products or other water conserving products, where available?	X	X	DOE G 413.3-6, Attachment A, Section III
60	Has the project/facility selected irrigation/landscaping contractors who are certified through a Water Sense labeled program?	X	X	DOE G 413.3-6, Attachment A, Section III
HPSB Guiding Principle IV -- Enhance Indoor Environmental Quality				
61	Does the project design and operate the facility for ventilation and thermal comfort?	X	X	DOE G 413.3-6, Attachment A, Section IV
62	Does the project/facility meet ASHRAE Standard 55-2004 for Thermal Environmental Conditions for Human Occupancy?	X	X	DOE G 413.3-6, Attachment A, Section IV
63	Does the project/facility meet ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality?	X	X	DOE G 413.3-6, Attachment A, Section IV
64	Does the project/facility design and operate the facility for moisture control?	X	X	DOE G 413.3-6, Attachment A, Section IV
65	Has the project/facility established and implemented a moisture control strategy for controlling moisture flows and condensation to prevent building damage, minimize mold contamination, and reduce health risks?	X	X	DOE G 413.3-6, Attachment A, Section IV
66	Does the project/facility design and operate the facility for day lighting?	X	X	DOE G 413.3-6, Attachment A, Section IV

LOI Set 12: Sustainability.				
	Sustainability Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
67	Does the project have design consideration to achieve a minimum daylight factor of 2% (excluding all direct sunlight penetration) in 75 percent of all space occupied for critical visual tasks?	X		DOE G 413.3-6, Attachment A, Section IV
68	Does the project have design consideration to provide automatic dimming controls or accessible manual lighting controls, and appropriate glare control?	X		DOE G 413.3-6, Attachment A, Section IV
69	Does the project/facility design the facility using low-emitting materials?	X	X	DOE G 413.3-6, Attachment A, Section IV
70	Have the project/facility specified materials and products with low pollutant emissions, including composite wood products, adhesives, sealants, interior pants and finishes, carpet systems, and furnishings?	X	X	DOE G 413.3-6, Attachment A, Section IV
71	Does the project/facility have a program to protect indoor air quality during construction?	X	X	DOE G 413.3-6, Attachment A, Section IV
72	Does the project/facility have a program to protect indoor air quality during construction per LEED criteria for new construction by following the recommended approach of the Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction, 2007?	X	X	DOE G 413.3-6, Attachment A, Section IV
73	Does the project/facility design and operate the facility for environmental tobacco smoke control?	X	X	DOE G 413.3-6, Attachment A, Section IV
74	Does the project/facility implement a policy and post signage indicating the smoking is prohibited within the building and within 25 feet of all building entrances, operable windows, and building ventilation intakes during building occupancy?	X	X	DOE G 413.3-6, Attachment A, Section IV
75	Does the project/facility provide a high level of thermal comfort system controlled by individual occupants or by specific groups in multi-occupant spaces to promote the productivity, comfort and well-being of building occupants?	X	X	DOE G 413.3-6, Attachment A, Section IV
76	Does the project/facility provide a comfortable thermal environment that supports the productivity and well-being of building occupants?	X	X	DOE G 413.3-6, Attachment A, Section IV

LOI Set 12: Sustainability.				
	Sustainability Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
77	Does the project/facility provide an assessment to building occupants for the thermal comfort over time?	X	X	DOE G 413.3-6, Attachment A, Section IV
HPSB Guiding Principle V -- Reduce Environmental Impacts of Materials				
78	Does the project/facility specify the recycled content of materials in the design per Section 6002 of the RCRA?	X	X	DOE G 413.3-6, Attachment A, Section V
79	For EPA-designated products, do they meet or exceed EPA's recycled content recommendations?	X	X	DOE G 413.3-6, Attachment A, Section V
80	For other products, do the materials with recycled content such that the sum of post-consumer recycled content plus ½ of the pre-consumer content constitutes at least 10% of the total value of the materials in the project?	X	X	DOE G 413.3-6, Attachment A, Section V
81	Does the project/facility specify the bio-based content of materials in the design per Section 9002 of the Farm Security and Rural Investment Act?	X	X	DOE G 413.3-6, Attachment A, Section V
82	For USDA-designated products, do they meet or exceed USDA's bio-based content Recommendations?	X	X	DOE G 413.3-6, Attachment A, Section V
83	For other products, does the project/facility use bio-based products made from rapidly renewable resources and certified sustainable wood products?	X	X	DOE G 413.3-6, Attachment A, Section V
84	Does the project/facility specify waste and materials management in its planning, design, and construction activities?	X	X	DOE G 413.3-6, Attachment A, Section V
85	Have adequate space, equipment, and transport accommodations for recycling been incorporated in the design?	X		DOE G 413.3-6, Attachment A, Section V
86	Have local recycling and salvage operations been identified during the project planning phase that could process project-related construction and demolition materials?	X		DOE G 413.3-6, Attachment A, Section V
87	During construction, has the project established a goal of at least 50% percent of the non-hazardous construction, demolition and land clearing materials can be recycled or salvaged?	X		DOE G 413.3-6, Attachment A, Section V
88	Does the project/facility specify the use of ozone depleting compounds in the design?	X		DOE G 413.3-6, Attachment A, Section V

LOI Set 12: Sustainability.				
	Sustainability Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
89	Does the project/facility eliminate the use of ozone depleting compounds during and after construction where alternative environmental preferable products are available, consistent with both the Montreal Protocol and Title VI of the Clean Air Act Amendments of 1990, or equivalent to overall air quality benefits that take into account life cycle impacts?	X	X	DOE G 413.3-6, Attachment A, Section V
90	Does the project specify the use of environmental preferable products in the design?	X		DOE G 413.3-6, Attachment A, Section V
91	Are the products selected that have a lesser or reduced effect on human and the environment over their lifecycle when compared with competing products or services that serve the same purpose?	X	X	DOE G 413.3-6, Attachment A, Section V
92	Does the project/facility promote the increase demand for building materials and products that are extracted and manufactured within the region?	X	X	DOE G 413.3-6, Attachment A, Section V
93	Does the project/facility support the use of indigenous resources and reducing the environmental impacts resulting from transportation?	X	X	DOE G 413.3-6, Attachment A, Section V
94	Do the materials from the harvest location to the manufacturing location exceed 500 miles?	X	X	DOE G 413.3-6, Attachment A, Section V
95	Is the distance from the manufacturing location to the project location exceeds 500 miles?	X	X	DOE G 413.3-6, Attachment A, Section V
96	During the purchasing stage, has the project/facility established a goal of at least 20% of the actual materials cost excluding labor and equipment?	X	X	DOE G 413.3-6, Attachment A, Section V

LOI Set 13: Human Factors

LOI Set 13: Human Factors				
	Human Factors Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Have the safety SSCs identified in accordance with DOE-STD-3009-94 been designed to address the following: • Human factors engineering that focuses on designing facilities, systems, equipment, and tools so they are sensitive to the capabilities, limitations, and needs of humans; and • Human reliability analysis that quantifies the contribution of human error to the facility risk for the;(1) the layout and design of SSCs for operation, construction, maintenance, and testing or surveillance; and (2) in the evaluation of failure probability of human relied upon actions?	X		DOE-STD-1189-2008, Section 7.7
2	Was the application of human factors for the design established as a design philosophy early in the conceptual design phase?	X		DOE-STD-1189-2008, Section 7.7
3	Through the design phases did this philosophy evolve to consider standard human interface issues?	X		DOE-STD-1189-2008, Section 7.7
4	Are human factors engineering principles and criteria integrated into the design, operation, and maintenance of the facility?	X		DOE G 420.1-1, Section 3.6
5	Did the human factors elements considered include as a minimum the following: equipment labeling, workplace environment (temperature and humidity, lighting, noise, vibration, and aesthetics), human dimensions, operating panels and controls, component arrangement, warning and annunciator systems, and communication systems?	X		DOE G 420.1-1, Section 3.6
6	Does the design consider the criteria found in Nuclear Regulatory Guide (NUREG) 0700, MIL-STD-1472D [Department of Defense (DOD)], and ANSI/IEEE1023 in the design of these elements?	X		DOE G 420.1-1, Section 3.6
7	Does the design of SIS comply with the requirements of ANSI/ISA 84.00.01-2004, Part I, Clause 11.2.6, which requires that the design takes into account, human-machine interfaces and their limitations, and follow good HFE practices?	X		DOE-STD-1195-2011, Section 2.7

LOI Set 13: Human Factors				
	Human Factors Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
8	Does the human factors engineering process implemented for the design include a HFE plan developed in accordance with DOE G 420.1-1, guided or supplemented by information in NUREG 0700, Human-System Interface Design Review Guidelines, ANSI/ISA 18.2, Management of Alarm Systems for the Process Industries, and other HFE references given in Table G-1 of DOE-STD-1195-2011?	X		DOE-STD-1195-2011, Section 2.7
9	Does the HFE process follow the applicable requirements of DOE O 414.1D for software and hardware configurations?	X		DOE-STD-1195-2011, Section 2.7
10	Does the human factors design consider and accommodate the range from the 5th percentile female to the 95th percentile male within the use population unless alternate upper and lower ranges are specified by DOE?	X	X	DOE-HDBK-1140-2001, Section 1.1.3
11	Does the design address the human factors guidance for designing systems, subsystems, equipment and facilities with regard to unitization, modularization and standardization?	X	X	DOE-HDBK-1140-2001, Section 2.1
12	Does the design address the human factors guidance for designing systems, subsystems, equipment and facilities with regard to unit layout, mounting and configuring?	X	X	DOE-HDBK-1140-2001, Section 2.2
13	Does the design address the human factors guidance for labeling, marking and coding as well as legends, placards, signs, markings as identified in DOE-HDBK-1140-2001 and the associated DOE standards and guidelines provided in NUREG 0700 or MIL-STD-1472F?	X	X	DOE-HDBK-1140-2001, Section 2.3
14	Does the design address the equipment accessibility guidance?	X	X	DOE-HDBK-1140-2001, Section 2.4
15	Does the design address the controls, displays, and protective devices guidance?	X	X	DOE-HDBK-1140-2001, Section 2.5
16	Does the design address the line and cable design guidance?	X	X	DOE-HDBK-1140-2001, Section 2.6
17	Does the design address the connector design guidance?	X	X	DOE-HDBK-1140-2001, Section 2.7
18	Does the design address the test and service point design guidance?	X	X	DOE-HDBK-1140-2001, Section 2.8
19	Does the design address the test equipment design guidance?	X	X	DOE-HDBK-1140-2001, Section 2.9

LOI Set 13: Human Factors				
	Human Factors Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
20	Does the design address the cover, case and shield design guidance?	X	X	DOE-HDBK-1140-2001, Section 2.10
21	Does the design address the fastener design and application guidance?	X	X	DOE-HDBK-1140-2001, Section 2.11
22	Does the design address the drawer and rack design guidance?	X	X	DOE-HDBK-1140-2001, Section 2.12
23	Does the design address the handle and grasp area design guidance?	X	X	DOE-HDBK-1140-2001, Section 2.13
24	Does the design address the maintenance safety guidance?	X	X	DOE-HDBK-1140-2001, Section 2.14
25	Does the design address the workspace and operations in non-workshop areas guidance?	X	X	DOE-HDBK-1140-2001, Section 3.1
26	Does the design address the facility design for work in radiological areas guidance?	X	X	DOE-HDBK-1140-2001, Section 3.2
27	Does the design address the workshops guidance?	X	X	DOE-HDBK-1140-2001, Section 3.3
28	Does the design address the radiological workshops guidance?	X	X	DOE-HDBK-1140-2001, Section 3.4
29	Does the design address the other shop and office areas guidance?	X	X	DOE-HDBK-1140-2001, Section 3.5
30	Does the design address the storage areas guidance?	X	X	DOE-HDBK-1140-2001, Section 3.6
31	Does the facility process and design address the guidance for maintenance support equipment?	X	X	DOE-HDBK-1140-2001, Chapter 4
32	Does the facility program use maintenance aids and procedures that follow the guidance of DOE-HDBK-1140-2001?	X	X	DOE-HDBK-1140-2001, Chapter 5
33	Does the facility have a preventative maintenance program?		X	DOE-HDBK-1140-2001, Section 6.1
34	Does the facility have monitoring programs to detect functional failure (including unacceptable performance degradation?		X	DOE-HDBK-1140-2001, Section 6.2
35	Does the facility have a servicing and adjustment program?		X	DOE-HDBK-1140-2001, Section 6.3
36	Does the facility have maintenance information management systems?		X	DOE-HDBK-1140-2001, Section 6.4
37	Does the facility have software and program maintenance processes?		X	DOE-HDBK-1140-2001, Section 6.5
38	Does the facility have a process to ensure maintainability design as part of system development?	X	X	DOE-HDBK-1140-2001, Section 6.6

LOI Set 14: Safeguards and Security

LOI Set 14: Safeguards and Security				
	Safeguards and Security Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
Critical Decision Requirements and Guidance				
1	Have general safeguards and security requirements been made for the recommended alternative and preliminary identification of alternative?	X		• DOE O 413.3B, Appendix C, Table 2.1; Appendix C, Section 20 • DOE G 413.3-3, Section V
2	Have these alternatives been evaluated with respect to their impact on mission needs, satisfaction of other requirement (such as safety) and other cost considerations.	X		DOE O 413.3B, Appendix C, Section 20
3	Have this input been incorporated into the conceptual design requirements for further development?	X		DOE O 413.3B, Appendix C, Section 20
4	Is a site security program representative assigned to the project and work with the FPD and other subject matter experts?	X	X	
5	Has the evaluation begun on the potential security needs in regards to the design basis threat?	X		DOE G 413.3-3, Section V
6	Has a Preliminary Security Vulnerability Assessment been conducted to account for the set of safeguards and security requirements?	X		DOE O 413.3B, Appendix C, Table 2.2; Appendix C, Section 20
7	Have the selected methods been evaluated to satisfy the requirements and address any potential risk acceptance issues?			DOE O 413.3B, Appendix C, Section 20
8	Have the Project Execution Plan and Performance Baseline been reviewed to ensure that cost, schedule, and integration aspects of safeguards and security been addressed, all feasible risk mitigation been identified, and concerns for which explicit line management risk acceptance are supported?	X		DOE O 413.3B, Appendix C, Section 20
9	Has the final Security Vulnerability Assessment Report been finalized?	X		DOE O 413.3B, Appendix C, Table 2.2; Appendix C, Section 20
10	Has the assessments been integrated into the final design and cost estimates?			
11	Has operations readiness review for security been conducted?	X		DOE G 413.3-3, Section V

LOI Set 14: Safeguards and Security				
	Safeguards and Security Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
12	Have testing requirements and acceptance criteria been prepared and implemented for security systems?	X		DOE G 413.3-3, Section V
13	Has safeguard and security training been conducted for the operations work force?	X		DOE G 413.3-3, Section V
14	Are there approved security plans and procedures for operations?	X		DOE G 413.3-3, Section V
Safety Interface				
15	Are security and safety professionals interfacing to identify and resolve any potential conflicts and/or identify risks that can impact safety, security, and project costs?	X		DOE-STD-1189
16	Is safety and security interface occurring to meet and resolve the DBT objectives while ensuring safety is appropriately considered?	X		DOE-STD-1189
17	Is security Vulnerability Assessment being performed, beginning early in the design and continued updating through the final design?	X		DOE-STD-1189
18	Are recommendations from the Vulnerability Assessments being incorporated into safety-in-design decisions, including the need for new technologies, or incorporating of new technologies, and factors into the safety bases analyses?	X		DOE-STD-1189
19	Is the strategy for security design documented and incorporated, as appropriate, into the SDS?	X		DOE-STD-1189
20	Is security and worker safety interface occurring to assure that workers and safety professionals can enter and exit the facility during emergency situations?	X		Best Management Practice
Safeguard and Security, and Cyber Security Requirements and Guidance11				
21	Has the project applied the requirements of DOE Graded Security Protection Policy?	X	X	470 series of DOE Directives
22	Has the project/facility determined the DBT Threat Level (TL)?	X	X	470 series of DOE Directives
23	Has all the security targets been identified, including government and private property, UCI, unclassified cyber systems, and people?	X	X	470 series of DOE Directives
24	Are there radiological, chemical, and biological	X	X	470 series of DOE

[11] Specific references are not provided for the 470 series (safeguards and security) and 205 series (cyber security) of DOE Directives since some of them are classified or Official Use Only.

LOI Set 14: Safeguards and Security				
	Safeguards and Security Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	sabotage targets identified for the project?			Directives
25	Has the project/facility established protection strategies as required DOE Directives?	X	X	470 series of DOE Directives
26	Have protection strategies been developed, such as using access control procedures, information compartmentalization, physical barriers, locks and keys, material controls, employee awareness, and training for areas such as Government property; unauthorized entry, trespass, site intruder, or terrorist; emergency response, and personnel and vehicle inspection?	X	X	470 series of DOE Directives
27	Has the project/facility established and implemented physical protection requirements?	X	X	470 series of DOE Directives
28	Has the project/facility incorporated and implemented Protective Force requirements established by DOE Directives?	X	X	470 series of DOE Directives
29	If appropriate, has the project/facility incorporated and implemented Material Control and Accountability requirements?	X	X	470 series of DOE Directives
30	Has the project/facility incorporated and implemented Personnel Security requirements?	X	X	470 series of DOE Directives
31	Is insider threat to the project/facility being minimized using security measures such as badging, pre-employment investigation and fitness for duty, training, and security awareness?	X	X	470 series of DOE Directives
32	Has the project/facility incorporated and implemented cyber security requirements?	X	X	• 470 series of DOE Directives • 205 series of DOE Directives
33	Are critical security and surveillance systems and devices being tested?	X	X	470 series of DOE Directives
34	Does the project/facility have procedures on reporting of incidents security concern within specific timelines based on actions, inactions, or events?	X	X	470 series of DOE Directives

LOI Set 15: Pressure Safety

LOI Set 15: Pressure Safety.				
	Pressure Safety Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Have written and documented safety policies and procedures been established to ensure that all pressure vessels and systems are designed, fabricated, tested, procured, inspected, maintained, repaired, and operated by trained and qualified personnel in accordance with applicable and sound engineering principles?	X	X	• 10 CFR 851, Appendix C to Part 851--Worker Safety and Health Functional Areas, Section 4, Pressure Safety • DOE O 440.1B, Attachment 1, Section 7
2	Are all pressure vessels, boilers, air receivers, and supporting piping systems conformed to the following applicable code or standard in place at time of installation or significant modification? • ASME Design and Construction of Boiler, Air Receivers, and Pressure Vessels; • ANSI/ASME B.31 Piping Code; • National Board Inspection Code NB-23; • Department of Transportation, 49 CFR Parts 100-199; and/or • Strictest applicable state and local codes.	X	X	• 10 CFR 851, Appendix C to Part 851—Worker Safety and Health Functional Areas, Section 4, Pressure Safety • DOE O 440.1B, Attachment 1, Section 7
3	If national consensus codes are not applicable, have implementing measures been established to provide equivalent protection and ensure safety equal to or superior to the intent of the ASME code? Measures must meet the following criteria: • (1) Design drawings, sketches, and calculations must be reviewed and approved by an independent design professional. Documented organizational peer review is acceptable. • (2) Qualified personnel must be used to perform examinations and inspections of materials, in-process fabrications, non-destructive tests, and acceptance tests. • (3) Documentation, traceability, and accountability must be maintained for each pressure vessel or system, including descriptions.	X	X	• 10 CFR 851, Appendix C to Part 851—Worker Safety and Health Functional Areas, Section 4, Pressure Safety • DOE O 440.1B, Attachment 1, Section 7
4	Have the design, pressure ratings, traceability, inspection, testing, operations,	X	X	• 10 CFR 851, Appendix C to Part 851—Worker

LOI Set 15: Pressure Safety.				
	Pressure Safety Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	repair, and maintenance requirements been described and documented for each pressure vessel or system?			Safety and Health Functional Areas, Section 4, Pressure Safety • DOE O 440.1B, Attachment 1, Section 7
5	Have all the components in the pressure system, especially components of pressure relief devices and control valves, been inspected, tested, and maintained as required by the applicable standards? **Note:** Inspections, testing, and maintenance may be done according to competently developed and peer-reviewed engineering and maintenance specifications, provided that they ensure safety equal to or superior to the intent of any applicable standard. This process must be documented.	X	X	• 10 CFR 851, Appendix C to Part 851—Worker Safety and Health Functional Areas, Section 4, Pressure Safety • DOE O 440.1B, Attachment 1, Section 7
6	Are qualified personnel in control of the selection and use of the pressure hardware, including quality control requirements, procurement specifications, and assembly of pressure components?	X	X	• 10 CFR 851, Appendix C to Part 851—Worker Safety and Health Functional Areas, Section 4, Pressure Safety • DOE O 440.1B, Attachment 1, Section 7
7	Are the personnel who design, build, and operate pressure systems trained and qualified through documented formal classroom attendance, testing, and on-the-job experience and/or training?	X	X	DOE O 440.1B, Attachment 1, Section 7
8	Are worker Involvement/Safety Committee(s) involved in making recommendations and/or in reviewing safety policies, addressing unusual problems and occurrences, and providing advice and assistance in pressure safety?	X	X	DOE O 440.1B, Attachment 1, Section 7
9	Has it been established that the worker and safety provisions of the 10 CFR 851 Rule do not supersede requirements in 10 CFR Part 830, Nuclear Safety Management, and appropriate sections of the ASME Boiler and Pressure Vessel Code that more appropriately apply to nuclear reactors and other DOE nuclear facilities?	X		DOE G 440.1-8, Section 3.6.4

LOI Set 15: Pressure Safety.				
	Pressure Safety Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
10	For the design of process equipment involving pressure safety, are safety-class and safety-significant equipment providing passive confinement been designed to suitable conservative criteria? **Note:** Process equipment includes pressure vessels, tanks, pumps, piping, valves, heat exchangers and glove boxes listed in Table 5.3 of DOE G 420.1-1.	X		DOE G 420.1-1, Section 5.2.2.2
11	Has the redundancy criteria been applied to the design of safety-class SSCs that involve active confinement process equipment (pumps, valves, etc.)?	X		• DOE G 420.1-1, Section 5.2.2.2 • DOE G 420.1-1, Section 5.1.1.2
12	Have all the applicable commercial codes been considered for the design of safety-significant and safety-class process equipment?	X		DOE G 420.1-1, Section 5.2.2.2, Table 5.3

LOI Set 16: Environmental Protection

LOI Set 16: Environmental Protection.				
	Environmental Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Has the NEPA strategy and analysis been prepared as part of the conceptual design?	X		• DOE O 413.3B • DOE-STD-1189-2008
2	Does the design meet the requirements of the applicable DOE Standards and the other regulatory agencies? (e.g., effluents, permits, etc.)	X		• DOE O 413.3B • DOE-STD-1189-2008
3	Can all materials at risk (e.g., radioactive, toxic, and hazardous) be identified?	X		DOE O 413.3B
4	Can preliminary design at this stage of the project demonstrate the potential to minimize the amount of hazardous material used or generated?	X		DOE O 413.3B
5	Can the estimated potential impacts to the environment from the construction and operation of the Proposed Action and its alternative be compared to applicable limits, standards, and or performance guidelines subject to federal environmental statutes such as the Clean Air Act?	X		DOE O 413.3B
6	Has a reasonable set of alternate approaches (at least three) been considered?	X		DOE O 413.3B
7	Were potential environmental impacts considered (to the extent design details allowed) in the evaluation of alternatives?	X		DOE O 413.3B
8	For the preferred alternative, has a preliminary system description been prepared in sufficient detail to support hazards analysis and feasibility studies for prevention or mitigation impact measures?	X		DOE O 413.3B
9	Have interfaces been performed with other project areas, such as consistency in treatment in accident analysis, with the facility safety basis evaluation?	X	X	DOE O 413.3B
10	(a) Has all the NEPA documentation been prepared and completed? (b) Has a Draft NEPA document been prepared and issued? (c) Has the Public Comment Period occurred? (d) Has the Draft NEPA document been revised?	X	X	• DOE O 413.3B • DOE O 451.1B

LOI Set 16: Environmental Protection.				
	Environmental Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	(e) Has the Final NEPA document been approved and issued? (f) Has a ROD been prepared and issued? (g) Has an Administrative Record been compiled? (h) Have the NEPA outputs been taken as input considerations for project design process?			
11	Has the contractor developed and implemented an environmental management system that is integrated into the site ISMS?			DOE 450.1A Contract Requirements Document (CRD) 1.
12	Does the environmental system: reflect the environmental management system elements and framework found in ISO 14001:2004 (E) International Standard or equivalent, including policies, procedures and training to identify operations and activities with significant environmental impacts; to manage, control, and mitigate the impacts of these operations and activities; and to assess performance, implement corrective actions where needed, and ensure continual improvement?		X	DOE 450.1A CRD 1.a.(1)
13	Does the environmental system include environmental, energy, and transportation objectives and measurable targets that are reviewed annually, updated as appropriate, and contribute to achieving the DOE Sustainable Environmental Stewardship goals found in Attachment 2 of DOE O 450.1A, Environmental Protection Program, dated 6-4-08, and the energy and transportation goals in the CRD in DOE O 430.2B, Departmental Energy, Renewable Energy and Transportation Management, dated 2-27 08.		X	DOE 450.1A CRD 1.a.(2)
14	Does the environmental system address tenant or concessionaire activities wherever such activities affect DOE's environmental, energy, and transportation management?		X	DOE 450.1A CRD 1.a.(3)
15	Does the environmental plan contain the elements of an Environmental Compliance Management Plan pursuant to the Council on Environmental Quality's Instructions for Implementing Executive Order 13423, page 9, section B, including: (a) A clear statement by senior leadership committing to achieve and maintain compliance with applicable environmental		X	DOE 450.1A CRD 1.a.(4)

LOI Set 16: Environmental Protection.				
	Environmental Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	protection requirements; (b) Clearly articulated roles and responsibilities related to environmental performance at all appropriate levels to ensure accountability for less than desired environmental performance; (c) An environmental compliance audit and review program that identifies compliance deficiencies and root causes of non-compliance; (d) Integration of compliance management information and resource allocation procedures to ensure that audit findings and root causes of non-compliance are tracked and addressed, including allocation of funding?			
16	Does the environmental management system encompass the environmental aspects of site operations and activities, including environmental aspects of energy and transportation functions, and it must promote the long-term stewardship of a site's natural and cultural resources throughout its design and construction, operation, closure, and post-closure life cycle?		X	DOE 450.1A CRD 1.b
17	Does the environmental management system address: sustainable practices for enhancing environmental, energy, and transportation management performance, as stipulated in Section 3(a) of EO 13423 and its Implementing Instructions?		X	DOE 450.1A CRD 1.b.(1)
18	Does the environmental management system address: protection of public health and the environment, including but not limited to: (a) Conformity with State Implementation Plans to attain and maintain national ambient air quality standards; (b) Implementation of a watershed approach for surface water protection; (c) Implementation of a site-wide approach for groundwater protection; (d) Protection of other natural resources, including biota; (e) Assessment of the hazard of engineered nanomaterials and implementation of appropriate environment, safety and health		X	DOE 450.1A CRD 1.b.(2)

LOI Set 16: Environmental Protection.				
	Environmental Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	controls?			
19	Does the environmental management system address protection of site resources from wild land fires consistent with site wild land, and operation fire management plans that consider the Federal Wildfire Management Policy recommendations?		X	DOE 450.1A CRD 1.b.(3)
20	Does the environmental management system address identification and protection of cultural resources?		X	DOE 450.1A CRD 1.b.(4)
21	Does the environmental management system address the conduct of environmental and effluent monitoring, as appropriate to characterize pre-operational conditions, and to detect, characterize, and respond to releases from site operations and activities; assess impacts; estimate dispersal patterns in the environment; characterize the pathways of exposure to members of the public; characterize the exposures and doses to individuals and the population; and evaluate the potential impacts to the biota in the vicinity of the release?		X	DOE 450.1A CRD 1.b.(5)
22	Does the environmental management system give assurance that analytical work for environmental and effluent monitoring supports data quality objectives, using a documented approach for collecting, assessing, and reporting environmental data?		X	DOE 450.1A CRD 1.b.(6)
23	Does the environmental management system address the conduct of appropriate operational assessments, such as pollution prevention opportunity assessments, and of site operations and activities to identify opportunities to implement sustainable practices as part of achieving DOE's Sustainable Environmental Stewardship goals found in Attachment 2 of DOE O 450.1A?		X	DOE 450.1A CRD 1.b.(7)
24	Has the environmental management system been validated using the criteria identified in DOE O 450.1A?		X	DOE 450.1A CRD 1.c
25	Has the environmental management system been the subject of a formal audit by a qualified party outside the control or scope of the environmental management system?		X	DOE 450.1A CRD 1.c.(1)(a)
26	Have the appropriate contractor senior management and DOE field office management		X	DOE 450.1A CRD

LOI Set 16: Environmental Protection.				
	Environmental Protection Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	recognized and addressed the findings of the audit?			1.c.(1)(b)
27	Have the appropriate senior manager accountable for implementation of the environmental management system, and the cognizant Field Officer Manager, declared conformance of the environmental management system to the requirements of this CRD?		X	DOE 450.1A CRD 1.c.(1)(c)
28	To remain fully implemented, has the environmental management system (at least every three years): (a) been audited by a qualified party outside the control or scope of the organization implementing the environmental management system, and (b) renewed, as appropriate, the conformance declaration 1c(1)(c)?		X	DOE 450.1A CRD 1.c.(3)
29	Does the contractor monitor progress toward meeting the requirements of paragraph 1a, 1b, and 1c of this CRD, and make such information available annually through the DOE operations/field/site office to the Senior Agency Officer (SAO) and the Office of Health, Safety and Security?		X	DOE 450.1A CRD 2

LOI Set 17: Emergency Preparation

LOI Set 17: Emergency Preparation.				
	Emergency Preparedness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Are plans in place for all types of emergencies including radiological, hazardous materials, biological hazardous agents and toxins, and natural phenomena such as earthquakes, tornados, hurricanes, floods?	X	X	• DOE O 151.1C Intro summary 1.f,4.a • DOE G 151.1-1A Chapter 1, 2.1
2	Have the following types of emergencies been considered: structure fires and explosions; natural phenomena impacts (e.g. wind, tornados, flood, earthquake); environmental releases; hazardous material releases; malevolent acts; workplace accidents/mass casualty events; hazards external to the facility/site; and accidental criticality?	X	X	DOE G 151.1-2 1.5
3	Does upper management support the emergency management plan?	X	X	DOE O 151.1C Chapter I 9. a. through w. and 10 a. through g
4	Are procedures in place to assure early recognition of an emergency?	X	X	• DOE O 151.1C III 3.d.(3)(a) • DOE G 151.1-5 3.9
5	Have stakeholders' (e.g. Federal, Tribal, State and local agencies) issues been identified early in process and addressed?	X	X	• DOE –STD-1189-2008 11 • DOE G 151.1-5 6.2
6	Does the Operational Emergency Base Program provide for integrated planning to meet response requirements identified in the Hazards Survey and at a minimum address the 9 items listed in DOE O 151.1C?	X	X	• DOE O 151.1C Chapter III 3.d • DOE G 151.1-1A Chapter 3; • DOE G 151.1-5 1.2
7	• Has a comprehensive emergency management program been developed that is commensurate with the facility-specific hazards, potential emergencies identified in the Hazard Survey, the Departmental directives and standards of performance, and includes all applicable requirements including those promulgated by other agencies? • Is it maintained and updated, as necessary due to changes in facility?	X	X	• DOE O 151.1C Chapter I 10.a., Chapter III 3.d • DOE –STD-1189-2008 7.12
8	Does each site/facility have an Operational Emergency Base Program that provides for compliance with the following regulations and plans developed by other Federal Agencies,	X	X	DOE O 151.1C III 2

LOI Set 17: Emergency Preparation.				
	Emergency Preparedness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	DOE/NNSA Offices and with State and local planning and preparedness requirements that apply? • Occupational Safety and Health Administration requirements for employee evacuation plans (29 CFR 1910.38) and notification systems (29 CFR 1910.165) • Federal property management regulations for occupant emergency programs (41 CFR 102-74.235 to 102-74.260) and accident and fire prevention (41 CFR 102-74-360) • Federal Emergency Management Agency requirements for emergency operations plans for State and local governments (44 CFR 302) that address similar hazards • Environmental Protection Agency requirements implementing the Comprehensive Environmental Response, Compensation, and Liability Act, embodied in the 40 CFR 300 series, including Title III, the Emergency Planning and Community Right-to-Know Act, embodied at 40 CFR 355.III-2 DOE O 151.1C 11-2-05 • Department of Transportation requirements for emergency response information (49 CFR 172.600 series) and hazardous materials training (49 CFR 172.700 series) • DOE O 440.1A, Worker Protection for DOE Federal and Contractor Employees, dated 3-27-98, which addresses requirements for planning for treatment of the injured during emergency or disaster situations			
9	• Has a Hazards Survey been done for each facility to identify conditions to be addressed by the comprehensive emergency management program including the following? • Identifying the emergency conditions (e.g., fires, work place accidents, natural phenomena, etc.) • describing the potential health, safety, or environmental impacts • indicating the need for further analyses of hazardous materials in an EPHA, based on the results of the hazardous material screening process described in DOE O	X	X	• DOE O 151.1C Chapter III 3.a • DOE G 151.1-2 1.1,1.4,1.8 • DOE G 151.1-3 4.4.1 • DOE G 151.1-5 4.1

LOI Set 17: Emergency Preparation.				
	Emergency Preparedness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	151.1C Chapter III 3.b • identifying the planning and preparedness requirements that apply to each type of hazard • Has the Hazards Survey been updated every 3 years and prior to significant changes to the site/facility or to hazardous material inventories?			
10	Has a Hazardous Material Screening Process been done to identify specific hazardous materials and quantities that, if released, could produce impacts consistent with the definition of an Operational Emergency? **Note:** Hazardous materials include radioactive material, chemicals, and biological agents and toxins.	X	X	• DOE O 151.1C Chapter III 3.b • DOE G 151.1-2 Appendix C • DOE G 151.1-3 4.4.1
11	• Has an EPHA been done to quantitatively analyze the potential release of or loss of control of hazardous materials as identified in the Hazards Survey? • Were the results used to determine the necessary personnel, resources, and equipment for the Operational Emergency Hazardous Material Program? • Has it been reviewed every 3 years and updated prior to significant changes to the site/facility or hazardous material inventories? • Does it include a determination of the size of the Emergency Planning Zone (EPZ)? • Is there an accurate and timely method for tracking changes in operations processes, or accident analyses that involve hazardous materials that allow sufficient time for emergency management personnel to review the EPHA and modify plans and procedures, as necessary?	X	X	• DOE O 151.1C Chapter IV 3.a • DOE G 151.1-2 1.5 • DOE G 151.1-3 4.4 • DOE G 151.1-5 4.2
12	Have site/facility-specific Emergency Action Levels been developed for the spectrum of potential Operational Emergencies identified by the Emergency Planning Hazards Assessment and do they include protective actions corresponding to each Emergency Action Level (EAL)?	X	X	• DOE O 151.1C Chapter IV 3. b.(3)(b) • DOE G 151.1-4 4.6
13	Have provisions been established to adequately assess the potential or actual onsite and offsite	X	X	• DOE O 151.1C Chapter IV 3.b.(5)

LOI Set 17: Emergency Preparation.				
	Emergency Preparedness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	consequences of an emergency? Will the provisions: • Ensure early recognition of an emergency; • be timely throughout the emergency; • be integrated with the event classification and protective action process; • incorporate monitoring of specific indicators and field measurements; and • be coordinated with Federal, State, local, and Tribal organizations?			• DOE –STD-1189-2008 7.12 • DOE G 151.1-2 1.6 • DOE G 151.1-5 3.9
14	• Has a formal exercise program been established to validate all elements of the emergency management program over a five-year period? • Are exercises evaluated? • Are outside agencies invited to participate at least every 3 years? • Is the facility's emergency response capability exercised annual and evaluated?	X	X	• DOE O 151.1C Chapter IV 4.b • DOE G 151.1-3 Chapter 3, 4.4.2, Chapter 4 • DOE G 151.1-5 5.3
15	Are building evacuation exercises conducted at least annually in accordance with Federal regulations (41 CFR 102-74-360), local ordinances, and National Fire Protection Association Standards?	X	X	• DOE O 151.1C Chapter III 4.b.(1) • DOE G 420.1-1 4.7.3
16	• Is there a readiness assurance program to assure that emergency plans, implementing procedures, and resources are adequate and sufficiently maintained, exercised, and evaluated, and that improvements are made in response to identified needs? • Does the program include the following components: Evaluations, Improvements, and Emergency Readiness Assurance Plans (ERAPs)?	X	X	• DOE O 151.1C Chapter X 1 • DOE G 151.1-3 1.5, Chapter 4, Appendix C • DOE G 151.1-5 5.4
17	Are provisions in place to conduct annual self-assessment of emergency management programs? Has the program been evaluated at least every 3 years by the Cognizant Field Element?	X	X	• DOE O 151.1C Chapter X 2.a.(1),(2) • DOE G 151.1-3 4.6, Appendix E
18	Have Performance Indicators been developed and used to track and capture data regarding the performance of the emergency management programs?	X	X	• DOE O 151.1C Chapter X 2.c

LOI Set 17: Emergency Preparation.				
	Emergency Preparedness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
19	Have provisions been established to categorize and classify emergency events?	X	X	• DOE O 151.1C Chapter IV 3.b.3 and Chapter V • DOE G 151.1-5 6.4 • DOE G 151.1-4 Chapter 4
20	• Are initial training and periodic drills provided to all workers who may be required to take protective actions (e.g., shelter-in-place; assembly, evacuation)? Is it provided when their expected actions change or when the emergency plan changes? • Is Refresher training provided annually to certified operators and supervisors and those workers who are likely to witness a hazardous material release and who are required to notify proper authorities of the release? • Are regulatory changes addressed during training? • Is Emergency-related information and training on site-specific conditions/hazards made available to offsite personnel who may be required to participate in response to an emergency at the site/facility?	X	X	• DOE O 151.1C Chapter III 4.a • DOE G 151.1-3 Chapter 2

21	• Are drills established to provide supervised, "hands-on" training for members of emergency response organizations?
	• Do drills cover the following?
	  • Emergency medical team response
	  • Hazardous Material (HAZMAT) response
	  • JIC activation
	  • Dose assessment drill
	  • Field monitoring drill
	  • Emergency notifications/communications with offsite agencies
	  • Protective Force interface with Fire Department
		X	X	• DOE O 151.1C Chapter IV 4.a
				• DOE G 151.1-3 2.8

22	Are both initial training and annual refresher training provided for instruction and demonstration of proficiency by all personnel comprising the emergency response organization or who may be emergency responders? Is training documented and	X	X	• DOE O 151.1C Chapter IV 4.a • DOE G 151.1-3 Chapter 2

LOI Set 17: Emergency Preparation.				
	Emergency Preparedness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	tracked?			
23	Does training cover the National Response Framework, NIMS, and the National Incident Management System? Should the emergency require DOE National Radiological Response Assets to augment the local response?	X	X	DOE G 151.1-1A 1.10
24	Has a comprehensive, coordinated, and documented program of training and drills been developed as required?	X	X	• DOE O 151.1.1C Chapter III 4.a. Chapter IV 4.a • DOE G 151.1-5 5.2
25	Has an Emergency Response Organization been established and maintained with overall responsibility for initial and ongoing response to and mitigation of emergency? Will it provide control at the scene consistent with the National Incident Management System's Incident Command System?	X	X	• DOE O 151.1C Chapter IV 3.b.(1) • DOE G 151.1-5 6.1 • DOE G 151.1-4 Chapter 1
26	• For Operational Emergencies, are provisions established for prompt initial notification of workers, emergency response personnel, and organizations, including appropriate DOE/NNSA elements and other Federal, State, Tribal, and local organizations? • Will they provide for continuing effective communication among the response organizations throughout an emergency? • Are notification and reporting requirements demonstrated in all emergency management exercises? • Are communications systems tested at least annually or as often as needed to ensure that communications systems are operational?	X	X	• DOE O 151.1C Chapter VIII 2.a • DOE G 151.1-5 6.5 • DOE G 151.1-4 Chapter
27	Has the site/facility prepared an Emergency Public Information Plan that provides the following? • identification of personnel, resources, facilities, and coordination procedures necessary to provide emergency public information • training and exercises for personnel who will interact with the media • a methodology for informing workers and the public of DOE/NNSA emergency plans and	X	X	• DOE O 151.1C Chapter IX 2.d • DOE G 151.1-5 6.5 • DOE G 151.1-4 9.3 • DOE G 151.1-4 9.7

LOI Set 17: Emergency Preparation.				
	Emergency Preparedness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	protective actions, before and during emergencies • coordination of public information efforts with State, local, and Tribal governments, and Federal emergency response plans, as appropriate			
28	Is adherence to emergency public information policies and requirements demonstrated during exercise evaluations, appraisals, and approved training programs?		X	DOE O 151.1C Chapter IX 3
29	Are provisions in place to establish a Joint Information Center for all Operational Emergency Hazardous Material Program facilities? Can it be adequately staffed with personnel trained to serve as spokesperson and news writer?	X	X	• DOE O 151.1C Chapter IX 4.b. (2) • DOE G 151.1-3 2.8 • DOE G 151.1-4 9.4
30	Have predetermined criteria for termination of emergencies been established.	X	X	• DOE O 151.1C Chapter IV 5.b.(1) • DOE G 151.1-5 6.10 • DOE G 151.1-4 10.3.1
31	Does the emergency management plan assure that termination is coordinated with State, Tribal, and local agencies and organizations responsible for offsite emergency response and notification?	X	X	• DOE O 151.1C Chapter III 5.b • DOE G 151.1-5 6.10
32	Has authority and lines of communication for making the termination decision been clearly defined in emergency plans and procedures?	X	X	DOE G 151.1-4 10.3.1
33	Have protective actions been predetermined for onsite personnel and the public? Do they include the following? • methods for controlling, monitoring, and maintaining records of personnel exposures to hazardous materials • procedures to implement the separate protective actions of evacuation and sheltering of employees • methods for controlling access to contaminated areas and for decontaminating personnel or equipment exiting the area • actions that may be taken to increase the effectiveness of protective actions [i.e., heating, ventilation, and air conditioning (HVAC) shutdown during sheltering]	X	X	• DOE O 151.1C Chapter IV 3.b.(6) • DOE G 151.1-5 3.10,4.3.3 • DOE G 151.1-4 7.3

LOI Set 17: Emergency Preparation.				
	Emergency Preparedness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• methods for providing timely recommendations to appropriate State, Tribal, or local authorities of protective actions, such as sheltering, evacuation, relocation, and food control • specific protective action criteria, based on the Base Order, paragraph 4a(14), for use in protective action decision making			
34	Are adequate facilities and equipment available and maintained to support emergency response including: • A facility for use as a command center and provisions for use of an alternate location if the primary command center is not available; and • Adequate personal protective equipment and other equipment and supplies to meet the needs determined by the results of the EPHA?	X	X	• DOE O 151.1C Chapter IV 3.b.(9) • DOE G 420.1-1 4.7.2 • DOE G 151.1-5 6.3 • DOE G 151.1-4 3.4,3.5
35	Have Recognition Factors been considered for observed and unobserved releases of biological agents or toxins?	X	X	DOE G 151.1-5 4.3.2

LOI Set 18: Technology Readiness

LOI Set 18: Technology Readiness.				
	Technology Readiness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1 (30%)	Prior to Critical Decision-2 approval, has a TRA been conducted and has a TMP been developed for a Major System Project where new critical technologies are being developed? **Note:** It is not required of a project if: (1) the technology was adequately demonstrated previously in one or more separate projects; or (2) the objective of the project is to research scientific principles.	X		DOE O 413.3B, Appendix C, Table 2.2 CD-2 Requirements
2	Has the PSO approved the TRA and TMP in the CD-2 approval process?	X		DOE O 413.3B, Appendix C, Table 2.2 CD-2 Requirements
3 (30%)	Has a TRA been conducted where a significant critical technology element modification occurs subsequent to CD-2?			DOE O 413.3B, Appendix C, Table 2.3 CD-3 Requirements
4	Has the PSO approved the TRA in the CD-3 approval process?	X		DOE O 413.3B, Appendix C, Table 2.3 CD-3 Requirements
5	When required were the TRA and TPM developed by the IPT?	X		DOE O 413.3B, Appendix C
6 (30%)	Does the overall project risk include the assessment of the technology readiness?	X		DOE O 413.3B, Appendix C
7	Has the project appropriately used both the TRA and the associated TRL scale to evaluate the technology maturity?	X		DOE O 413.3B, Appendix C
8	Using the TRA and TRL, is the project appropriately managing the technical and cost risks to the project?	X		DOE O 413.3B, Appendix C
9	For projects where the technological readiness is a significant concern, have TRAs been considered and/or performed for alternatives under consideration?	X		DOE O 413.3B, Appendix C
10	Does the TMP Plan detail the steps necessary for developing the technologies that are less mature than desired to the point where they are ready for project insertion?	X		DOE O 413.3B, Attachment 2
11	Did the project determination of for a facility	X	X	DOE-STD-1189-2008,

LOI Set 18: Technology Readiness.				
	Technology Readiness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	modification considered the use of new technology in determination of whether the modification is classified as a major modification?			Table 8-1
12	Has the project developed and implemented a formal methodology for assessing technology readiness consistent with the recommendations in GAO-07-336, *Major Construction Projects Need a Consistent Approach for Assessing Technology Readiness to Help Avoid Cost Increases and Delays*?	X		• GAO-07-336, *Major Construction Projects Need a Consistent Approach for Assessing Technology Readiness to Help Avoid Cost Increases and Delays* • DOE G 413.3-4A, *Technology Readiness Assessment Guide*
13	Has the project/program implemented a TDP consistent with the guidance in DOE G 413.3-4A?	X		• DOE G 413.3-4A; Section 1.3.1
14	Is the TDP a comprehensive planning document describing technology development activities required for the successful execution of the project, and the development relationship to the overall project scope and schedule relative to project phases?	X		• DOE G 413.3-4A; Section 1.3.1
15	Does the TDP address process needs identification, selection, system engineering, evaluation, performance verification and demonstrations?	X		• DOE G 413.3-4A; Section 1.3.1
16 (30%)	Was a technical risk assessment performed to identify risks that may affect the achievement of technical objectives that ultimately affect cost, schedule and performance?	X		• DOE O 413.3B • DOE G 413.3-4A; Section 1.3.1
17 (30%)	Are the results of technology development assessments and studies documented and reviewed to determine the validity of the approach that best meets project goals, objectives, and the physical, functional, performance, and operational requirements of the project at the best value; to include testing and validation of all required functions, including any safety functions?	X		• DOE O 413.3B • DOE G 413.3-4A; Section 1.3.1
18 (30%)	Has performance verification been completed following design and before beginning construction?	X		• DOE O 413.3B • DOE G 413.3-4A; Section 1.3.1

LOI Set 18: Technology Readiness.				
	Technology Readiness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
19 (30%)	Did the verification process address performance of the selected process or equipment on both the component level and from an integrated system perspective?	X		• DOE O 413.3B • DOE G 413.3-4A; Section 1.3.2
20	Has the project established IPT teams to conduct TRA reviews?	X		• DOE O 413.3B • DOE G 413.3-4A; Section 1.3.4
21	Has the project/program implemented and TRA Process model consistent the guidance of DOE G 413.3-4A.	X		• DOE O 413.3B • DOE G 413.3-4A; Section 2
22	Does the TRA process as implemented include the three sequential steps: Identifying the Critical Technology Elements (CTEs); Assessing the TRL; and Developing the TMP?	X		• DOE O 413.3B • DOE G 413.3-4A; Section 2
23	Does the program/project have a defined process that will ensure the identification of the CTEs consistent with the guidance of the Section 3?	X		• DOE O 413.3B • DOE G 413.3-4A; Section 3
24	Does the program/project have a defined process that will ensure the identification of the TRL consistent with the guidance of the Section 4?	X		• DOE O 413.3B and DOE G 413.3-4A; Section 4
25	Does the program/project have a defined process that will ensure the development of a TMP consistent with the guidance of DOE G 413.3-4A?	X		• DOE O 413.3B • DOE G 413.3-4A; Section 5
26 (30%)	Are the basic chemical processes an exact replication of the processes at another facility?	X		BEP
27 (30%)	Are the basic chemistries analyzed and tested at full scale, and proven by analysis and tests?	X		BEP
28 (30%)	Is the proof of process based on a pilot plant?	X		BEP
29 (30%)	Are all the chemical designs (principal and supporting systems) completed, verified, tested?	X		BEP
30 (60%)	Are the quantities, toxicity, flammability, criticality, OSHA regulated-potential, of all flow streams and stored materials characterized?	X		BEP

LOI Set 18: Technology Readiness.				
	Technology Readiness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
31 (60%)	Is the process hazard analysis (event trees and fault trees, HAZOP, what if, etc.) completed?	X		BEP
32 (30%)	Is there a potential for runaway reactions, by off-specification chemistries, contaminants, in-leakage of air, water or heat-transfer liquid, loss of agitation or mixing, hot spots, delayed reactions, backflow, excessive pre-heating, loss of purge, loss of inerting gas, etc.)?	X		BEP
33 (30%)	Are the analyses of rates of heat and gas evolution from reactions or decomposition completed?	X		BEP
34 (30%)	Is there a potential for exothermic reactions?	X		BEP
35 (30%)	Is there a potential for explosion (deflagration or detonation)?	X		BEP
36 (30%)	Have alternatives been studied to minimize hazardous (toxic, flammable, pyrophoric, volatile, contaminated) materials inventory?	X		BEP
37 (30%)	Have alternatives been studied to minimize hazardous reactions?	X		BEP
38 (30%)	Have alternatives been studied to prevent criticality?	X		BEP
39 (30%)	Have alternatives been studied to reduce radiation levels and facilitate access for inspections and maintenance?	X		BEP
40 (30%)	Have alternatives been studied to reduce radiation contamination?	X		BEP
41 (30%)	Have alternatives been studied for the use of lower energy systems (lower pressure or temperature)?	X		BEP
42 (60%)	Is the plant designed with redundancy to permit single active failure of critical equipment or components following the design-basis accident?	X		BEP
43 (30%)	What is the basis for the throughput predictions?	X		BEP
44 (30%)	Are the physical characteristics (viscosity, boiling point, melting point, vapor pressure, etc.) of the process fluids characterized and tested?	X		BEP
45 (30%)	Are the hydraulic mixing, blending, separation processes verified and tested?	X		BEP

LOI Set 18: Technology Readiness.				
	Technology Readiness Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
46 (30%)	Is the potential for settlement, heels, build-up, blockage analyzed, tested?	X		BEP
47 (60%)	What is the safety logic underpinning the system design (interlocks, operator actions, etc.)?	X		BEP
48 (30%)	Are the flow rates and heat transfers designs of the basic chemical systems completed and verified by tests?	X		BEP
49 (60%)	Are the flow rates and heat transfers designs of the secondary systems completed and verified by tests?	X		BEP
50 (30%)	Are the process flow diagrams complete and verified for all systems?	X		BEP
51 (60%)	Are the P&ID complete and verified for all systems?	X		BEP
52 (60%)	Are the systems protected from over-pressure (relief systems, flares, etc.)?	X		BEP
53 (60%)	Is over-flow in tanks, basins, prevented?	X		BEP
54 (60%)	Are the minimum-maximum envelopes of safe operation defined (temperature-pressure, heatup-cooldown rates, flow rates, plugging, loss of flow, loss of relief capacity, product quantities, ambient and environment, natural phenomena hazards, etc.)?	X		BEP

LOI Set 19: Waste Management[12]

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
General Requirements				
1	Are work areas located together, as much as practical, related to air supply and exhaust, decontamination, and areas where there is a potential for cross-contamination, in order to minimize the spread of contamination, and waste collection, packaging, and disposition?	X		DOE-G-420.1, Section 3.4 (*Architectural*)
2	• If mixed or hazardous wastes will be managed, do facility access controls take into account RCRA for hazardous waste (and mixed waste) treatment, storage, and disposal facilities? • Do access controls prevent unauthorized: Entry to active portions of the facility? • Contact with the waste? • Disturbance of the waste? • Additionally do access controls have : • 24-hour surveillance or security force? • A means of entry control at all times? • Postings visible from any approach from 25 feet away (Danger – Unauthorized Personnel Keep Out)?	X	X	• DOE-G-420.1, Section 3.4.1 (*Access Controls*) • 40 CFR 264.14 (*Security*)
3	Does design to facilitate deactivation incorporate facility features that aid in the removal of surplus radioactive and chemical materials; storage tank cleanout and maintenance; stabilization of contamination and process materials; and the removal of hazardous, mixed, and radioactive wastes?	X		DOE-G-420.1, Section 3.7.1 (*Deactivation*)
4	Does facility design incorporate waste minimization features such as walls, ceilings, and floors in areas vulnerable to contamination, which are finished with washable or strippable coverings? Are metal liners used in areas that have the potential to become highly contaminated? Are cracks, crevices, and joints filled and finished smooth to prevent accumulation of	X		DOE-G 420.1, Section 3.7.2 (*Decontamination*)

[12]Include High Level Waste, Transuranic Waste, and Low Level Waste.

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	contaminated material and thus minimize the generation of waste during operation, maintenance, and decommissioning?			
5	• For HLW, TRU, and LLW facilities, has a proposed decommissioning method or plan leading to reuse been described in the design? • For HLW Facilities, do decommissioning project plans contain waste management plans? • Are deactivated facilities closed per the CERCLA process?	X		• DOE-M-435.1, Chapter II(2)(e), Chapter III-M(2)(c) and Chapter IV-M(2)(c) (*Facility Design*) • DOE-M 435.1, Chapter II(U)(1) and (2) (*Closure*) • DOE-G 420.1, Section 3.4.1 (*Decommissioning*) • DOE-G 430.1-4 (*Decommissioning Implementation Guide*)
6	Are liquid radioactive and hazardous waste collection, transfer, and storage systems designed to avoid the dilution of radioactive or hazardous waste by waste of lower concentrations of radioactivity, toxicity, or other hazard?	X		DOE-G 420.1, Section 4.4.2 (*Special Considerations and Good Engineering Practices*)
7	• Are facility process systems designed to minimize waste production and mixing of radioactive, hazardous, and nonradioactive waste? • Are hazardous waste streams (types, sources, and quantities) identified early in the design process and prevention practices (e.g., chemical substitution, use of less hazardous materials) incorporated to reduce waste generation and costs? • Are management strategies (storage, treatment, and disposal systems) described in the documented safety analysis? • Are potential accidental releases from waste management systems addressed during hazards analysis in preliminary and detailed design?	X		• DOE-STD-1189-2008 (*Integrating Safety into the Design Process*), Section 7.11 (*Radiological and Hazardous Waste Management*) • DOE-O-420.1B (*Facility Safety*)
8	Are waste management and storage systems (unless demonstrated the risk is acceptable) designed to remain functional following a design-basis accident and facilitate the maintenance of a safe shutdown condition?	X		DOE-G 420.1, Section 4.5 (*Waste Management*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
9	For HLW Facilities, is at least one confinement barrier designed to withstand the effects of design-basis accidents?	X		DOE-G 420.1, Section 4.5 (*Waste Management*)
10	• Has a site-wide radioactive waste management plan been developed, documented, implemented, and maintained? • Does the waste management program use a systematic approach for planning, executing, and evaluating the site-wide management of radioactive waste in a manner that supports the Complex-Wide Radioactive Waste Management Programs?		X	• DOE-M 435.1-1 Chapter I(F)(1) (*Site-wide Radioactive Waste Management Program*) • DOE-G 420.1, Section 4.5 (*Waste Management*)

11	• Has a radioactive waste management basis been developed and maintained for each DOE radioactive waste management facility, operation, and activity?
	• Has this basis document been reviewed and approved prior to beginning operations?
	• Does the Radioactive Waste Management Basis:
	  • Reference or define the conditions under which the facility may operate based on the radioactive waste management documentation?
	  • Include the applicable elements identified in the specific waste-type chapters of DOE-M 435-1.1?
	  • Use the graded approach process?
			X	• DOE-M 435.1-1, Chapter I (F)(2) (*Radioactive Waste Management Basis*)
				• DOE-G 420.1, Section 4.5 (*Waste Management*)

12	• Does the site implement pollution prevention and waste minimization programs? • Are these programs effective in reducing the amount of waste generated? How is this verified?		X	• DOE-M 435.1-1, Chapter I (F)(3) (*Pollution Prevention and Waste Minimization*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
13	• If on-site DOE or off-site DOE facilities are not practical or cost effective, is there a program for the documentation and approval of exemption for the use of non-DOE facilities (i.e., Off-site determination) for the storage, treatment, or disposal of waste? • Are programs in place to assure that the non-DOE facility complies with all applicable regulatory requirements, licenses and		X	• DOE-M 435.1-1, Chapter I (F)(4) (*Approval for the Use of Non-DOE Facilities*) • DOE-G 420.1, Section 4.5 (*Waste Management*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	permits? • Are host states and compacts consulted prior to approval of an off-site determination? • Are appropriate NEPA reviews completed and are NEPA values incorporated into applicable CERCLA documentation? • Is DOE Headquarters consulted with prior to approval of off-site determination and notified prior to the first shipment?			

14	• Does management and disposal of radioactive waste resulting from environmental restoration (ER) activities, including decommissioning, meet the substantive requirements of DOE O 435.1 and DOE-M 435.1-1?
	• If ER activities use the CERCLA process, is it verified that compliance with all substantive requirements of DOE O 435.1, not met through the CERCLA process, is demonstrated including:
	  • Performance assessments?
	  • Performance objectives?
	  • Composite analyses per the CERCLA process?
	• Has the DOE Site manager submitted to the Deputy Assistant Secretary for ER activities involving development and management of radioactive waste disposal facilities under CERCLA:
	  • Certification to the Deputy Assistant Secretary for Environmental Restoration that compliance with the substantive requirements of DOE O 435.1, have been met through application of the CERCLA process?
	  • Decision documents (e.g., Record(s) of Decision) or any other document that serve as the authorization to dispose, to the Deputy Assistant Secretary for Environmental Restoration for approval?
			X	• DOE-M 435.1-1, Chapter I (F)(5) (*Environmental Restoration, Decommissioning, and other Cleanup Waste*)
				• DOE-G 420.1, Section 4.5 (*Waste Management*)

15	• Have radioactive waste acceptance requirements for facilities that receive waste for storage, treatment, or disposal been developed, reviewed, approved and implemented?		X	• DOE-M 435.1-1, Chapter I (F)(6) (*Radioactive Waste Acceptance Requirements*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Have radioactive waste acceptance requirements been established for disposal facilities for the receipt, evaluation, and acceptance of waste?			• DOE-G 420.1, Section 4.5 (*Waste Management*)
16	• Has a comprehensive waste management program been developed, reviewed, approved, and implemented for waste generation planning, characterization, certification, and transfer? • Do programs address characterization of waste, preparation of waste for transfer, certification that waste meets the receiving facility's radioactive waste acceptance requirements, and transfer of waste? • Do these programs include and address applicable state requirements per statutory agreements (e.g., Tri-Party Agreement at Hanford)?		X	• DOE-M 435.1-1, Chapter I (F)(7) (*Radioactive Waste Generator Requirements*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
17	Are closure plans developed, reviewed, approved, and implemented for radioactive waste management facilities per applicable requirements for each waste type?	X	X	• DOE-M 435.1-1, Chapter I (F)(8) (*Closure Plans*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
18	Are defense-in-depth principles, including but not limited to levels of engineered and administrative controls to provide protection to the public, workers, and the environment incorporated, where potential uncertainties or vulnerabilities warrant their use, when reviewing and approving radioactive waste management activities and documents?		X	• DOE-M 435.1-1, Chapter I (F)(9) (*Defense-in-Depth*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
19	• Are programs in place to provide oversight of radioactive waste management facilities, operations, and activities? • Do these programs ensure radioactive waste management program activities are conducted per the site radioactive waste management basis?		X	• DOE-M 435.1-1, Chapter I (F)(10) (*Oversight*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
20	Are training and qualification programs implemented for designated radioactive waste management program personnel, and the training is commensurate with job duties and responsibilities (e.g., personnel characterizing, designating, certifying waste shipments, etc.)?		X	• DOE-M 435.1-1, Chapter I (F)(11) (*Training and Qualification*) • DOE-G 420.1, Section 4.5 (*Waste*

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
				Management) • 49 CFR 172.700 (*Training*)
21	Are ALARA principles for radiation protection incorporated when reviewing and approving radioactive waste management activities?		X	• DOE-M 435.1-1, Chapter I (F)(12) (*ALARA*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
22	• Are all radioactive, hazardous, and mixed waste stored in a manner that protects the public, workers, and the environment in accordance with the Program radioactive waste management basis? • Is the integrity of waste storage is maintained for the expected time of storage (e.g., exceed RCRA storage requirements per 40 CFR or the site's RCRA or CERCLA Permit(s)? • Do storage areas meeting waste performance objectives for protection of the public and environment when the waste is removed from storage and prepared for disposal?		X	• DOE-M 435.1-1, Chapter I (F)(13) (*Storage*) • 40 CFR 268.50 (*Prohibition on Storage*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
23	• Are programs and procedures in place to ensure all wastes requiring treatment are treated in a manner that protects the public, workers, and the environment and in accordance with a radioactive waste management basis? • Are RCRA/mixed wastes either treated per approved on-site procedures and requirements or sent off-site for treatment prior to disposal? Does on-site treatment, if performed, adhere to RCRS permit requirements?		X	• DOE-M 435.1-1, Chapter I (F)(14) (*Treatment*) • 40 CFR 268.40 (*Treatment Standards*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
24	• Are programs and procedures in place, which ensure radioactive waste is disposed in a manner that protects the public, workers, and the environment and in accordance with a radioactive waste management basis? • Are specific Transuranic or LLW documentation, including performance assessments and composite analyses (and/or appropriate CERCLA documentation) reviewed and approved at the field office level prior to forwarding them to Headquarters for		X	• DOE-M 435.1-1, Chapter I (F)(15) (*Disposal*) • DOE-G 420.1, Section 4.5 (*Waste Management*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	approval? • Are disposal facilities operated in accordance with disposal authorizations? • Are performance assessment and composite analysis periodically reviewed and updated?			
25	Are audits, surveillances, and management reviews conducted for all waste management facilities as required, including, but not limited to assuring compliance with conditions of the disposal authorization statements?		X	• DOE-M 435.1-1, Chapter I (F)(16) (*Monitoring*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
26	Are wastes, which to the extent practical, may be generated under a program that is classified for national security reasons declassified, rendered suitable for unclassified waste management, or disposed in a disposal facility which accepts classified wastes for disposal (e.g., Nevada National Security Site Disposal Facility)?		X	• DOE-M 435.1-1, Chapter I (F)(17) (*Material and Waste Declassification for Waste Management*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
27	• Are waste incidental to reprocessing determinations made by either the "citation" or "evaluation" process described in Chapter II, Section B [*Waste Incident to Reprocessing* (WIR)] of this DOE M 435.1-1? • If waste is determined via the "evaluation process" to be WIR, is DOE-EM consulted and coordinated with to obtain a WIR determination prior to disposal?		X	• DOE-M 435.1-1, Chapter I (F)(18) (*Waste Incidental to Reprocessing*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
28	• Is a process developed and implemented for identifying the generation of waste with no identified path to disposal? • Is a process in place to ensure said waste generating processes are reviewed and approved prior to waste generation? • Are processes in place to ensure DOE headquarters is notified of the decisions to generate a waste with no identified path to disposal?		X	• DOE-M 435.1-1, Chapter I (F)(19) (*Waste with no Identified Path Forward*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
29	• Does the site corrective actions management program include Waste Management programs and procedures, which ensure adherence to the requirements of DOE Order 435.1, DOE-M-435.1-1, RCRA, and CERCLA requirements, as applicable?		X	• DOE-M 435.1-1, Chapter I (F)(20) (*Corrective Action*) • DOE-G 420.1, Section 4.5 (*Waste Management*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Does the corrective actions management program address conditions that are not protective of the public, workers, or the environment? • Does the process allow workers, through the appropriate level of management, to stop or curtail work when they discover conditions that pose an imminent danger or other serious hazard to workers or the public, or are not protective of the environment?			
30	Do all personnel understand they are responsible for identifying and reporting radioactive waste management facilities, operations, or activities that do not meet the requirements of radioactive waste management programs or that pose a threat to the safety of the public, workers, or the environment?		X	• DOE-M 435.1-1, Chapter I (G)(1) (*Corrective Action*) • DOE-G 420.1, Section 4.5 (*Waste Management*)
High Level Waste (HLW)				
31	• Are determinations for Wastes Incidental to Reprocessing (WIR) completed in order to classify wastes as other than high-level waste per the citation or evaluation process, as provided in DOE-M 435.1-1? • If evaluated per the evaluation process, are determinations that any waste is incidental to reprocessing, by the evaluation process, developed under good record-keeping practices, with an adequate quality assurance process, and documented to support the determinations as either low-level or Transuranic waste?		X	DOE-M 435.1-1, Chapter II B. (*Waste Incidental to Reprocessing*)
32	• Does the site-wide radioactive waste management program include a description of the HLW systems engineering management program to support decision-making related to nuclear safety? • Does this program include HLW requirements analysis, functional analysis and allocation, identification of alternatives, and alternative selection and system control?		X	DOE-M 435.1-1, Chapter II E. (*Site-wide Radioactive Waste Management Program*)
33	• Has the site developed a basis document for the management of HLW, which includes: • Generator waste certification program? • Waste acceptance and certification requirements for pre-treatment, treatment,	X		DOE-M 435.1-1, Chapter II F (*Radioactive Waste Management Basis*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	and storage facilities?			
34	• From a quality assurance program perspective, are the product quality requirements, as specified in RW-0333P applied to HLW items and activities important to waste acceptance and product quality? • Are the evaluation and assessment requirements and associated implementing procedures met for HLW for waste and product acceptance?	X	X	• DOE-M 435.1-1, Chapter II G (*Quality Assurance Program*) • DOE/RW-0333P (*OCRWM Quality Assurance Requirements and Description*) Note: This document is applicable to QA requirements for HLW that would be sent to Yucca Mountain, but is cited in DOE-M 435.1-1
35	Do waste acceptance requirements for all high-level waste storage, pretreatment, or treatment facilities, operations, and activities specify, at a minimum, the following: • Allowable activities and/or concentrations of specific radionuclides? • An acceptable waste form that ensures the chemical and physical stability of the waste under conditions that might be encountered during transfer, storage, pretreatment, or treatment? • The basis, procedures, and levels of authority required for granting exceptions to the waste acceptance requirements, which shall be contained in each facility's waste acceptance documentation? Is each exception request documented, including its disposition as approved or not approved? • Is pre-treatment, treatment, storage, packaging, and other operations designed and implemented in a manner that will ultimately comply with DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms,* or DOE/RW-0351P, *Waste Acceptance System Requirements Document*, for non-vitrified, immobilized high-level waste?		X	• DOE-M 435.1-1, Chapter II J (*Waste Acceptance*) • DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms* • DOE/RW-0351P, *Waste Acceptance System Requirements Document*
36	• Does the receiving facility evaluate waste for acceptance, including confirmation that the technical and administrative requirements have been met?		X	• DOE-M 435.1-1, Chapter II J (*Waste Acceptance*) • DOE/EM-0093, *Waste*

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Has a process for the disposition of non-conforming wastes been established?			*Acceptance Product Specifications for Vitrified High-Level Waste Forms* • DOE/RW-0351P, *Waste Acceptance System Requirements Document*
37	Is planning performed prior to waste generation to address the entire life cycle for all high-level waste streams?		X	• DOE-M 435.1-1, Chapter II K (*Waste Generation Planning*) • DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms*)
38	Are procedures in place to ensure HLW streams with no identified path to disposal are not generated unless under approved conditions which, at a minimum, address: • Programmatic need to generate the waste? • Characteristics and issues preventing the disposal of the waste? • Safe storage of the waste until disposal can be achieved? • Activities and plans for achieving final disposal of the waste (compliance with DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms*)?		X	• DOE-M 435.1-1, Chapter II K (*Waste Generation Planning*) • DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms*)

39	• Is characterization documentation developed in sufficient detail to ensure safe management and compliance with the waste acceptance requirements of the storage or disposal facility receiving the waste?
	• Is the data quality objectives process (or comparable process) used for identifying characterization parameters and acceptable uncertainty in characterization data?
	• Does characterization data, at a minimum, include the following information, which may be relevant to the management of the waste:
	  • Physical and chemical characteristics?
	  • Volume including the waste and any
			X	• DOE-M 435.1-1, Chapter II L (*Waste Characterization*)
				• DOE/EM-0093 (*Waste*
				• *Acceptance Product Specifications for Vitrified High-Level Waste Forms*)
				• DOE/RW-0351P (*Waste Acceptance System Requirements Document*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	solidification media? • Radionuclides or source information sufficient to describe the approximate radionuclide content of the waste? • Any other information which may be needed to demonstrate compliance with the requirements of the DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms,* or DOE/RW-0351P, *Waste Acceptance System Requirements Document*, for non-vitrified, immobilized high-level waste? • Does the waste characterization processes yield sufficient chemical and physical data to clearly identify any hazardous characteristics that may degrade the ability of structures, systems, and components to perform their radioactive waste management function?			
40	• Has a waste certification program been developed, documented, and implemented to ensure that the waste acceptance requirements of facilities receiving high-level waste for storage, pretreatment, treatment, and disposal are met? • Has the waste certification program designated officials who have the authority to certify and release waste for shipment; and specify what documentation is required for waste generation, characterization, shipment, and certification? • Are the program requirements auditable, retrievable, and are storage of required documentation and records retention period specified in procedures and/or program documents? • Prior to transfer, is HLW certified as meeting the waste acceptance requirements before it is transferred to the facility receiving the waste? • Is HLW, which is certified as meeting the waste HLW acceptance requirements for transfer to a storage, pretreatment, treatment, or disposal facility, managed in a manner that maintains its certification status?		X	DOE-M 435.1-1, Chapter II M (*Waste Certification*)
41	• Are procedures in place to ensure HLW is not transferred to a storage, treatment, or		X	• DOE-M 435.1-1, Chapter II N (*Waste*

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	disposal facility until personnel responsible for the facility receiving the waste authorize the transfer? • Is waste characterization data and generation, storage, pretreatment, treatment, and transportation information for HLW transferred with or be traceable to the waste? • Are records and transfer requirements for HLW forms in canisters comply with DOE/EM-0093, *Waste Acceptance Product Specification for Vitrified High-Level Waste Forms,* or DOE/RW-0351P, *Waste Acceptance System Requirements Document*, for non-vitrified, immobilized high-level waste adhered to when required? • Does immobilized HLW meet the packaging and transportation requirements of the DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms,* or DOE/RW-0351P, *Waste Acceptance System Requirements Document*, for non-vitrified, immobilized high-level waste?			*Transfer*) • DOE/EM-0093, *Waste Acceptance Product Specification for Vitrified High-Level Waste Forms* • DOE/RW-0351P, *Waste Acceptance System Requirements Document*
42	<u>Site Evaluation</u> • Are proposed locations for high-level waste facilities evaluated to identify relevant features that should be avoided or must be considered in facility design and analyses? • Is each site proposed for a new HLW facility or expansion of an existing HLW facility evaluated, considering environmental characteristics, geotechnical characteristics, and human activities? • Are proposed sites with environmental characteristics, geotechnical characteristics, or human activities for which adequate protection cannot be provided through facility design deemed unsuitable for the location of the facility?	X		• DOE-M 435.1-1, Chapter II P (*Site Evaluation and Facility Design*) • DOE O 420.1 (*Facility Safety*) • DOE 5480.22 (*Technical Safety Requirements*) • DOE 5480.23 (*Nuclear Safety Analysis Reports*)
43	<u>Facility Design</u> Regarding HLW facility design: • Are Safety (Class and Safety Significant) Structures, Systems, and Equipment for HLW storage, pre-treatment, and treatment facilities designed consistent with DOE O 420.1, DOE 5480.22, and DOE 5480.23?	X		• DOE-M 435.1-1, Chapter II P (*Site Evaluation and Facility Design*) • DOE O 420.1 (*Facility Safety*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Are confinement (secondary confinement systems and welded construction requirements for piping systems) requirements adhered to? • Are lifting devices designed as safety class or safety significant systems with interlocks, which will fail safe? • Do ventilation systems use appropriate filtration to maintain radioactive airborne within limits and maintain potentially flammable and/or explosive mixtures non-flammable and non-explosive and prevent deflagration or detonation? • Does facility design consider future decontamination and decommissioning? • Is maintaining personnel radiation exposures ALARA incorporated into the design of each HLW facility? • Do storage facilities incorporate means for waste retrieval and complements existing storage facilities for safe HLW transfer? • Do new HLW storage tanks contribute to adherence to confinement requirements by avoiding or minimizing critical degradation rates and incorporate features to facilitate structural integrity program execution? • Are instrumentation and controls incorporated to provide volume inventory and monitoring data and prevent spills, leaks, and over-flows from tanks or confinement systems, as well as detection of rapid detection of failed confinement and/or abnormal conditions?			• DOE 5480.22 (*Technical Safety Requirements*) • DOE 5480.23 (*Nuclear Safety Analysis Reports*)
44	Do facilities intended for management of HLW awaiting pretreatment, treatment or disposal, unless stated otherwise, adhere to the following requirements: • Confinement systems operated and maintained so as to preserve the design basis? • Operate secondary confinement systems, where provided, to prevent any migration of wastes or accumulated liquid? • A structural integrity program is developed for each HLW storage tank site to verify the structural integrity and service life of each tank to meet operational requirements for	X		• DOE-M 435.1-1, Chapter II Q (*Storage*) • DOE/EM-0093, *Waste Acceptance Product Specification for Vitrified High-Level Waste Forms* • DOE/RW-0351P, *Waste Acceptance System Requirements Document*

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	storage capacity? • Is the program capable of verifying current leak-tightness and structural strength of each tank; identifying corrosion, fatigue, and other critical degradation modes, adjusting tank waste chemistry, calibrating cathodic protection systems, wherever employed, and implementing other necessary corrosion protection measures; providing credible projections as to when structural integrity of each tank can no longer be assured; and identifying additional controls necessary to maintain an acceptable operating envelope?			
45	Do facilities intended for management of HLW awaiting pretreatment, treatment or disposal, unless stated otherwise, adhere to the following requirements: • For each HLW storage tank in-service known or suspected to have leaked, is a modified structural integrity program developed to identify the safe operational envelope? Do capabilities include: • Verifying structural strength? • Identify corrosion, fatigue and other critical degradation modes? • Adjusting the chemistry of tank waste, • Calibrating cathodic protection systems, wherever employed, and other necessary corrosion protection measures? • Determining which of the tanks may remain in service by identifying an acceptable safe operating envelope? • Providing credible projections when the acceptable safe operational envelope can no longer be assured; and any additional controls necessary to maintain the acceptable safe operational envelope?	X		• DOE-M 435.1-1, Chapter II Q (*Storage*) • DOE/EM-0093, *Waste Acceptance Product Specification for Vitrified High-Level Waste Forms* • DOE/RW-0351P, *Waste Acceptance System Requirements Document*
46	• When physical activities pose additional vulnerabilities, are alternative measures implemented to provide an acceptable storage operations envelope, including the structural integrity of other storage components to assure leak tightness and structural strength? • Are canisters of immobilized high-level waste	X		• DOE-M 435.1-1, Chapter II Q (*Storage*) • DOE/EM-0093, *Waste Acceptance Product Specification for Vitrified High-Level Waste Forms* • DOE/RW-0351P,

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	awaiting shipment to a repository: • Stored in a suitable facility? • Segregated and clearly identified to avoid commingling with low-level, mixed low-level or Transuranic wastes? • Monitored to ensure that storage conditions are consistent with DOE/EM–0093, *Waste Acceptance Product Specifications for Vitrified High-level Waste Forms,* or DOE/RW-0351?			*Waste Acceptance System Requirements Document*

47	• Do deactivated HLW facilities/sites meet the decommissioning requirements of DOE O 430.1A, *Life-Cycle Asset Management* and the requirements of DOE 5400.5, *Radiation Protection of the Public and the Environment*, for release?
	• Are deactivated HLW facilities/sites closed per the CERCLA process or an approved closure plan, which includes the following elements (residual radioactive waste present in facilities to be closed shall satisfy WIR requirements):
	  • Unless closed per the options above, is a closure plan developed for each deactivated HLW facility/site being closed, which is approved prior to physical closure activities?
	• Is the closure plan updated periodically to reflect current analysis and status of individual facility closure actions?
	• Does the closure plan include, at a minimum, the following elements:
	  • Identify the closure standards and performance objectives to be applied?
	  • A strategy for allocating waste disposal facility performance objectives from the closure standards identified in the closure plan among the facilities/units to be closed at the site?
	  • An assessment of the projected performance of each unit to be closed relative to the performance objectives allocated to each unit under the closure plan?
	  • An assessment of the projected
		X	X	• DOE-M 435.1-1, Chapter II U (*Closure*)
				• DOE O 430.1A, *Life-Cycle Asset Management*
				• DOE O 458.1, *Radiation Protection of the Public and the Environment*

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	composite performance of all units to be closed at the objectives and closure standards identified in the closure plan? • Any other relevant closure controls (monitoring plan, institutional controls, and land use limitations maintained in the closure activity)?			
Transuranic Waste (TRU)				

48	• Do TRU facilities, operations, and activities have a waste management basis consisting of physical and administrative controls to ensure the protection of workers, the public, and the environment?
	• Are the following controls included in the radioactive waste management basis:
	  • Generator waste certification program?
	  • Treatment facility waste acceptance requirements and waste certification program?
	• Are storage facilities included in the waste acceptance requirements and the waste certification program?
		X		DOE-M 435.1-1, Chapter III D (*Radioactive Waste Management Basis*)

49	• For off-normal or emergency situations involving liquid TRU storage or treatment, is spare capacity with adequate capabilities maintained to receive the largest volume of liquid contained in any one storage tank or treatment facility? • Are contingency storage and facilities maintained in an operational condition when waste is present? • Are pipelines and auxiliary facilities necessary for the transfer of liquid waste to contingency storage maintained in an operational condition when waste is present?	X		DOE-M 435.1-1, Chapter III E (*Contingency Actions*)
50	• Are corrective actions implemented whenever necessary to ensure adherence to the waste management basis? • Are operations curtailed or facilities shut down for failure to establish, maintain, or operate consistent with an approved radioactive waste management basis?		X	• DOE O 435.1 (*Radioactive Waste Management*) • DOE-M 435.1-1, Chapter III F (*Corrective Actions*)
51	Do waste acceptance requirements for all TRU storage, treatment, or disposal facilities,		X	• DOE-M 435.1-1, Chapter III G (*Waste*

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	operations, and activities specify, at a minimum, the following: • Allowable activities and/or concentrations of specific radionuclides? • Acceptable waste form and/or container requirements that ensure chemical and physical stability of waste under conditions that might be encountered during transportation, storage, treatment, or disposal? • Restrictions or prohibitions on waste or containers that may adversely affect waste handlers or compromise facility or waste container performance? • Requirement to identify TRU as defense or non-defense, and limitations on acceptance? • The basis, procedures, and levels of authority required for granting exceptions to the waste acceptance requirements, which shall be contained in each facility's waste acceptance documentation. Each exception request shall be documented, including its disposition as approved or not approved?			*Acceptance*) • DOE/WIPP-02-3122 (*Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*)
52	• Does the receiving facility have requirements to evaluate waste for acceptance, including confirmation that technical and administrative requirements have been met? • Has a process for disposition of non-conforming wastes been established?		X	• DOE-M 435.1-1, Chapter III G (*Waste Acceptance*) • DOE/WIPP-02-3122 (*Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*)

53	• Prior to waste generation, has planning been performed to address the entire life cycle for TRU streams?
	• Are TRU streams with no identified path to disposal generated only in accordance with approved conditions which, at a minimum, address:
	  • Programmatic need to generate the waste? Characteristics and issues preventing the disposal of the waste?
	  • Safe storage of the waste until disposal can be achieved?
	  • Activities and plans for achieving final disposal of the waste?
		X		• DOE-M 435.1-1, Chapter III H (*Waste Generation Planning*)
				• DOE/WIPP-02-3122 (*Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	

54	• Is TRU characterized using direct or indirect methods, and the characterization documented in sufficient detail to ensure safe management and compliance with the waste acceptance requirements of the facility receiving the waste?
	• Is the data quality objectives process or comparable process used for identifying characterization parameters and acceptable uncertainty in characterization data?
	• Does characterization data, at a minimum, include the following information relevant to the management of the waste:
	  • Physical and chemical characteristics?
	  • Volume, including the waste and any stabilization or absorbent media?
	  • Weight of the container and contents?
	  • Identities, activities, and concentrations of major radionuclides?
	  • Characterization date?
	  • Generating source?
	  • Packaging date?
	  • Other information which may be needed to prepare and maintain the disposal facility performance assessment or demonstrate compliance with applicable performance objectives?
			X	• DOE-M 435.1-1, Chapter III I (*Waste Characterization*)
				• DOE/WIPP-02-3122 (*Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*)

55	• Has a waste certification program been developed, documented, and implemented to ensure that the waste acceptance requirements of facilities receiving TRU for storage, treatment, or disposal are met? • Does the waste certification program designate officials who have the authority to certify and release waste for shipment; and specify what documentation is required for waste generation, characterization, shipment, and certification? • Does the program shall provide requirements for auditing, retrieving, and storage of required documentation and specify the records retention period?		X	• DOE-M 435.1-1, Chapter III J (*Waste Certification*) • DOE/WIPP-02-3122 (*Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*)
56	• Is TRU certified as meeting waste acceptance requirements before it is transferred to the		X	• DOE-M 435.1-1, Chapter III J (*Waste*

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	receiving facility? • Is TRU that has been certified as meeting the waste acceptance requirements for transfer to a storage, treatment, or disposal facility managed in a manner that maintains its certification status?			*Certification*) • DOE/WIPP-02-3122 (*Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*)
57	Has a documented process been established and implemented for transferring responsibility for management TRU and for ensuring availability of relevant data, including: • Ensuring TRU is not transferred to a storage, treatment, or disposal facility until personnel responsible for the facility receiving the waste authorize the transfer? • Waste characterization data, container information, and generation, storage, treatment, and transportation information when TRU is transferred, which is traceable to the waste?		X	• DOE-M 435.1-1, Chapter III K (*Waste Transfer*) • DOE/WIPP-02-3122 (*Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*)
58	<u>Site Evaluation</u> • Are proposed locations for Transuranic waste facilities evaluated to identify relevant features that should be avoided or must be considered in facility design and analyses? • Is each site proposed for a new TRU facility or expansion of an existing TRU facility evaluated considering environmental characteristics, geotechnical characteristics, and human activities? • Are proposed sites with environmental characteristics, geotechnical characteristics, and human activities for which adequate protection cannot be provided through facility design identified as unsuitable for the location of the facility?	X		• DOE-M 435.1-1, Chapter III M (*Site Evaluation and Facility Design*) • DOE/WIPP-02-3122 (*Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*)
59	<u>Facility Design</u> Are the following facility requirements and general design criteria, at a minimum, applied: • TRU systems and components designed to maintain waste confinement? • Design of TRU treatment and storage facilities includes ventilation, if applicable, through an appropriate filtration system to maintain the release of radioactive material within specified requirements and guidelines?	X		• DOE-M 435.1-1, Chapter III M (*Site Evaluation and Facility Design*) • DOE/WIPP-02-3122 (*Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Ventilation, which maintains potentially flammable and/or explosive mixtures non-flammable and non-explosive and prevent deflagration or detonation? • Areas in new and modifications to existing TRU management facilities subject to contamination with radioactive or other hazardous materials are designed to facilitate decontamination, including impacts on potential for facility reuse? • Engineering controls are incorporated in the design and engineering of TRU treatment and storage facilities to provide volume inventory data and to prevent spills, leaks, and overflows from tanks or confinement systems? • Monitoring and/or leak detection capabilities are incorporated in the design and engineering of TRU storage, treatment, and disposal facilities to provide rapid identification of failed confinement and/or other abnormal conditions?			
60	• Is TRU in storage treated to prevent the waste from being readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water? • Prior to storage, is pyrophoric materials treated, prepared, and packaged to be nonflammable? • Is TRU stored in a location such protection is provided to the integrity of waste for the expected time of storage and minimizes worker exposure? • Has a process been developed and implemented to inspect and maintain containers of Transuranic waste, thus ensuring container integrity?	X	X	DOE-M 435.1-1, Chapter III N (*Storage*)
61	• Have plans for the removal of TRU from retrievable earthen-covered storage facilities been established and maintained? • Prior to commencing waste retrieval activities, has each waste storage site been evaluated to determine relevant information on types, quantities, and location of radioactive and hazardous chemicals as necessary to protect	X	X	DOE-M 435.1-1, Chapter III N (*Storage*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	workers during the retrieval process?			

62	• Are the following parameters, at a minimum, sampled or monitored:
	  • Temperature?
	  • Pressure (for closed systems)?
	  • Radioactivity in ventilation exhaust and liquid effluent streams?
	  • Flammable or explosive mixtures of gases?
	• Do facility monitoring programs include verification that passive and active control systems have not failed?
	• Is all TRU in storage monitored, as prescribed by the appropriate facility safety analysis, to ensure the wastes are maintained in safe condition?
	For facilities storing liquid TRU, are the following parameters monitored:
	  • Liquid level and/or waste volume?
	  • Significant waste chemistry parameters?
		X	X	• DOE-M 435.1-1, Chapter III Q (*Monitoring*)
				• DOE/WIPP-02-3122 *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*)

Low Level Waste (LLW)				
63	Does the LLW basis include: • Waste generator certification program? • Waste acceptance requirements for treatment, storage, and disposal facilities? • For disposal facilities the composite analysis, performance assessment, disposal authorization statement, closure plan, and monitoring plan?	X		DOE-M 435.1-1, Chapter IV D (*Radioactive Waste Management Basis*)
64	• For off-normal or emergency situations involving high activity or high hazard liquid LLW storage or treatment, is spare capacity with adequate capabilities maintained to receive the largest volume of liquid contained in any one storage tank or treatment facility? • Are contingency storage tanks maintained in operational condition? • Are pipelines and auxiliary facilities necessary for the transfer of high activity or high hazard liquid LLW to contingency storage maintained in an operational condition?	X	X	DOE-M 435.1-1, Chapter IV E (*Contingency Actions*)
65	• Are corrective actions implemented whenever necessary to ensure adherence to the requirements of the waste management		X	DOE-M 435.1-1, Chapter IV F (*Corrective Actions*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	basis? • Are operations curtailed or facilities shut down for failure to establish, maintain, or operate consistent with an approved radioactive waste management basis?			
66	Do waste acceptance requirements for all LLW storage, treatment, or disposal facilities, operations, and activities shall specify, at a minimum, the following: • Allowable activities and/or concentrations of specific radionuclides? • Acceptable waste form and/or container requirements that ensure the chemical and physical stability of waste? • Restrictions or prohibitions on wastes that may adversely affect personnel, the facility or container performance?		X	DOE-M 435.1-1, Chapter IV G (*Waste Acceptance*)
67	• Are the following specified in LLW disposal facility waste acceptance requirements: • Contribute to achieving long-term stability of the facility, minimizing long-term active maintenance, minimizing subsidence, and minimizing contact of water with waste? • Void spaces reduced to the extent practical? • Liquid LLW or LLW converted into a form that contains as little freestanding liquid as is reasonably achievable; cannot exceed 1 percent of containerized waste volume; 0.5 percent of the waste volume after processed to a stable form? • Waste must not be readily capable of detonation or of explosive decomposition or reaction at anticipated pressures and temperatures, or of explosive reaction with water? • Pyrophoric materials treated, prepared, and packaged to be nonflammable? • Waste must not contain, or be capable of generating by radiolysis or biodegradation, quantities of toxic gases, vapors, or fumes harmful to the public or workers or disposal facility personnel, or the long-term structural stability of the disposal site? • Gaseous forms must be packaged such		X	DOE-M 435.1-1, Chapter IV G (*Waste Acceptance*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	that the pressure does not exceed 1.5 atmospheres absolute at 20° C? • Are the basis, procedures, and levels of authority for granting WAC exceptions documented in site procedures and adhered to? • Is each exception request documented, including its disposition as approved or not approved? • Does the receiving facility evaluate waste for acceptance, including confirmation that the technical and administrative requirements have been met, including establishment of a process for dispositioning non-conforming wastes?			

68	• Prior to waste generation, is planning performed to address the entire life cycle for all LLW streams?
	• Are LLW streams with no identified path to disposal generated per approved conditions which, at a minimum, addresses:
	  • Programmatic need to generate the waste?
	  • Characteristics and issues preventing the disposal of the waste?
	  • Safe storage of the waste until disposal can be achieved?
	  • Activities and plans for achieving final disposal of the waste?
			X	DOE-M 435.1-1, Chapter IV H (*Waste Generation Planning*)

69	• Is LLW characterized using direct or indirect methods, and the characterization documented in sufficient detail to ensure safe management and compliance with the waste acceptance requirements of the facility receiving the waste?
	• Is the data quality objectives process, or a comparable process, used for identifying characterization parameters and acceptable uncertainty in characterization data?
	• Does characterization data, at a minimum, include the following information relevant to the management of the waste:
	  • Physical and chemical characteristics?
	  • Volume, including the waste and any stabilization or absorbent media?
			X	DOE-M 435.1-1, Chapter IV I (*Waste Characterization*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Weight of containers and their contents? • Identities, activities, and concentrations of major radionuclides? • Characterization date? • Generating source? • Any other information which may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with applicable performance objectives?			
70	• Is a waste certification program developed, documented, and implemented, which ensures adherence to waste acceptance requirements of facilities receiving LLW for storage, treatment, and disposal? • Does the waste certification program designate officials who have the authority to certify and release waste for shipment? • Does the waste certification program specify what documentation is required for waste generation, characterization, shipment, and certification? • Does the program provide requirements for auditing, retrieving, and storage of required documentation and specify records retention periods?		X	DOE-M 435.1-1, Chapter IV J (*Waste Certification*)
71	Is LLW certified as meeting waste acceptance requirements before it is transferred to the facility receiving the waste and managed in a manner that maintains its certification status?		X	DOE-M 435.1-1, Chapter IV J (*Waste Certification*)
72	• Is there a documented process established and implemented for transferring responsibility for management of LLW and for ensuring availability of relevant data? • Are site procedures in place to ensure LLW is not transferred to a storage, treatment, or disposal facility until personnel responsible for the facility receiving the waste authorize the transfer? • Is waste characterization data, container information, and generation, storage, treatment, and transportation information for LLW transferred with or traceable to the waste?		X	DOE-M 435.1-1, Chapter IV K (*Waste Transfer*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
73	• Are procedures in place to ensure LLW is packaged to provide containment and protection for the duration of anticipated storage periods and until disposal is achieved or waste has been removed from the container? • Are waste packages equipped with vents or other measures if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container? • Are procedures in place to ensure containers of LLW are marked such that their contents can be identified? • Is the volume and number of shipments of LLW, to the extent practical, minimized? • Are site procedures and programs in place to ensure, when followed, ensures adherence to US Department of Transportation requirements and/or the site-wide transportation safety document for the transport of radioactive, hazardous, and mixed waste?		X	• DOE-M 435.1-1, Chapter IV L (Packaging & Transportation) • DOE O 460.1C, Section 4.a.(1) (*Packaging and Site Safety Requirements*) • 49 CFR 171 to 180 (*Hazardous Materials Regulations*) • 49 CFR 350 to 399 (*Federal Motor Carrier Safety Regulations*)

74	<u>Site Evaluation</u>
	• Are proposed locations for LLW facilities evaluated to identify relevant features that should be avoided or must be considered in facility design and analyses?
	• Is each site, proposed for a new LLW facility or expansion of an existing LLW facility, evaluated to consider environmental characteristics, geotechnical characteristics, and human activities?
	• Does this evaluation include the capability of the site to demonstrate, at a minimum, whether it is:
	  • Located to accommodate the projected volume of waste to be received?
	  • Located in a flood plain, a tectonically active area, or in the zone of water table fluctuation?
	  • Located where radionuclide migration pathways are predictable and erosion and surface runoff can be controlled?
	• Are proposed sites where adequate
		X		DOE-M 435.1-1, Chapter IV M (*Site Evaluation and Facility Design*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	protection cannot be provided through facility design documented as unsuitable for the location of the facility? • Are LLW disposal facilities sited to achieve long-term stability and to minimize, to the extent practical, the need for active maintenance following final closure?			
75	<u>LLW Treatment and Storage Facility Design</u> • Are LLW systems and components designed to maintain waste confinement? • Does the design of LLW treatment and storage facilities include ventilation, if applicable, through an appropriate filtration system to maintain the release of radioactive material within specified requirements and guidelines? • Does the ventilation system maintain potentially flammable and/or explosive mixtures non-flammable and non-explosive and prevent deflagration or detonation? • Are areas in new LLW management facilities and modifications to existing facilities, subject to contamination with radioactive or other hazardous materials designed to facilitate decontamination? • For such facilities, is the proposed decommissioning method or a conversion method leading to reuse described? • Are engineering controls incorporated in the design and engineering of LLW treatment and storage facilities to provide volume inventory data and to prevent spills, leaks, and overflows from tanks or confinement systems? • Are monitoring and/or leak detection capabilities incorporated in the design and engineering of LLW treatment and storage facilities to provide rapid identification of failed confinement and/or other abnormal conditions?	X		DOE-M 435.1-1, Chapter IV M (*Site Evaluation and Facility Design*)
76	<u>Low-Level Waste Disposal Facility Design</u> • Are LLW systems and components designed to maintain waste confinement? • Does the design of LLW treatment and storage facilities include ventilation, if	X		DOE-M 435.1-1, Chapter IV M (*Site Evaluation and Facility Design*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	applicable, through an appropriate filtration system to maintain the release of radioactive material within specified requirements and guidelines? • Does the ventilation system maintain potentially flammable and/or explosive mixtures non-flammable and non-explosive and prevent deflagration or detonation? • Are LLW disposal facilities designed to achieve long-term stability and to minimize to the extent practical, the need for active maintenance following final closure? • Are LLW disposal facilities designed to minimize to the extent practical, the contact of waste with water during and after disposal?			
77	• Is LLW in storage, if required, treated to prevent the waste from being readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water? • Prior to storage, is potentially pyrophoric materials treated, prepared, and packaged to be nonflammable? • Is LLW that has an identified path to disposal stored longer than one year prior to disposal, except for storage for decay, or as otherwise authorized by the Site Manager? • Is LLW stored in a location and manner that protects the integrity of waste for the expected time of storage and minimizes worker exposure? • Is LLW that does not have an identified path to disposal characterized as necessary to meet the data quality objectives and minimum characterization requirements, to ensure safe storage, and to facilitate disposal? • Is characterization information for all LLW in storage maintained as a record in accordance with the Site requirements for records management? • Has a process been developed and implemented for inspecting and maintaining containers of LLW to ensure container integrity is not compromised? • Is LLW in storage managed to identify and		X	DOE-M 435.1-1, Chapter IV N (*Storage and Staging*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	segregate LLW from mixed LLW? Is the staging of LLW, for the purpose of the accumulation of such quantities of waste as necessary to facilitate transportation, treatment, and disposal conducted to ensure staging/storage does not exceed 90 days?			
78	Are LLW treatment processes to provide more stable waste forms and to improve the long-term performance of a LLW disposal facility implemented as necessary to meet the performance objectives of the disposal facility?		X	DOE-M 435.1-1, Chapter IV O (*Treatment*)
79	<u>Performance Objectives</u> • Are LLW disposal facilities are sited, designed, operated, maintained, and closed so that a reasonable expectation exists that the following performance objectives will be met for waste disposed of after September 26, 1988: • Dose to representative members of the public does not exceed 25 mrem (0.25 mSv) in a year total effective dose equivalent from all exposure pathways, excluding the dose from radon and its progeny in air? • Dose to representative members of the public via the air pathway does not exceed 10 mrem (0.10 mSv) in a year total effective dose equivalent, excluding the dose from radon and its progeny? • Release of radon is less than a 20 pCi/m^2/s (0.74 Bq/m^2/s) average at the surface of the disposal facility (alternatively, a 0.5 pCi/1 (0.0185 Bq/l) limit of air may be applied at the boundary of the facility)?	X		DOE-M 435.1-1, Chapter IV P (*Disposal*)
80	<u>Performance Assessment (PA)</u> • Is a site-specific PA is prepared and maintained for LLW disposed of after September 26, 1988? • Does the PA shall include calculations for 1,000 years after closure of potential doses to representative future members of the public and potential releases from the facility to provide a reasonable expectation that the performance objectives are not exceeded as a result of operation and closure of the facility? Does the PA include: • Analyses performed to demonstrate	X	X	DOE-M 435.1-1, Chapter IV P (*Disposal*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	compliance with performance objective requirements, and to establish limits on concentrations of radionuclides for disposal based on the performance measures for inadvertent intruders, based on reasonable activities in the critical group of exposed individuals? • Unless otherwise specified, is the assumption of average living habits and exposure conditions in representative critical groups of individuals projected to receive the highest doses is appropriate? • Are the likelihood of inadvertent intruder scenarios considered in interpreting the results of the analyses and establishing radionuclide concentrations, if adequate justification is provided? • Does the point of compliance correspond to the point of highest projected dose or concentration beyond a 100 meter buffer zone surrounding the disposed waste (a larger or smaller buffer zone may be used if adequate justification is provided)?			
81	• Do PAs address reasonably foreseeable natural processes that might disrupt barriers against release and transport of radioactive materials? • Do PAs use DOE-approved dose coefficients (dose conversion factors) for internal and external exposure of reference adults? • Do PAs include a sensitivity/uncertainty analysis? • Do PAs include a demonstration that projected releases of radionuclides to the environment shall be maintained as low as reasonably achievable? • Do PAs, for purposes of establishing limits on radionuclides that may be disposed of near-surface, include an assessment of impacts to water resources? • For purposes of establishing limits on the concentration of radionuclides that may be disposed of near-surface, do PAs include an assessment of impacts calculated for inadvertent intruders for a temporary period into the LLW disposal facility?	X	X	DOE-M 435.1-1, Chapter IV P (*Disposal*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• For intruder analyses, are institutional controls assumed to be effective in deterring intrusion for at least 100 years following closure? • Do intruder analyses use performance measures for chronic and acute exposure scenarios, respectively, of 100 mrem (1 mSv) in a year and 500 mrem (5 mSv) TEDE, excluding radon in air?			
82	<u>Composite Analysis (CA)</u> • For disposal facilities which received waste after September 26, 1988, is a site-specific radiological composite analysis prepared and maintained that accounts for all sources of radioactive material that may be left at the site and may interact with the LLW disposal facility, contributing to the dose projected to a hypothetical member of the public from the existing or future disposal facilities? • Are performance measures consistent with requirements for protection of the public and environment and evaluated for a 1,000 year period following disposal facility closure? • Are composite analysis results used for planning, radiation protection activities, and future use commitments to minimize the likelihood that current LLW disposal activities will result in the need for future corrective or remedial actions to adequately protect the public and the environment?	X	X	DOE-M 435.1-1, Chapter IV P (*Disposal*)
83	<u>PA and CA Maintenance</u> • Is the PA and CA maintained to evaluate changes that could affect the performance, design, and operating bases for the facility? • Does PA and CA maintenance includes the conduct of research, field studies, and monitoring needed to address uncertainties or gaps in existing data and updated to support the final facility closure? • Are additional iterations of the PA and CA conducted as necessary during the post-closure period? • Additionally, are the PA and CA reviewed and revised when: • Changes in waste forms or containers?	X		DOE-M 435.1-1, Chapter IV P (*Disposal*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Radionuclide inventories? Facility design and operations Closure concepts • Improved understanding of the performance of the waste disposal facility, in combination with the features of the site on which it is located, alters the conclusions or the conceptual model(s) of the existing PA or CA? • Is a determination of the continued adequacy of the PA and CA is made on an annual basis and consider results of data collection and analysis from research, field studies, and monitoring? • Are annual summaries of LLW disposal operations prepared with regarding conclusions and recommendations of the PA and CA and a determination of the need to revise the PA and CA?			
84	<u>Disposal Authorization</u> • Has a disposal authorization statement been obtained prior to construction of a new LLW disposal facility, per the schedule in the Complex-Wide LLW Management Program Plan? • Is the disposal authorization statement issued, based on a review of the facility's PA and CA, PA and CA maintenance, preliminary closure plan, and preliminary monitoring plan? • Does the disposal authorization statement specify limits and conditions on construction, design, operations, and closure of the LLW facility based on these reviews? • Is the disposal authorization statement a part of the radioactive waste management basis for a disposal facility?		X	DOE-M 435.1-1, Chapter IV P (*Disposal*)
85	<u>Disposal Facility Operations</u> • Is the disposal facility design and operation consistent with the disposal facility closure plan? • Does disposal facility design and operation lead to disposal facility closure that provides a reasonable expectation that performance objectives will be met, and be disposed in		X	DOE-M 435.1-1, Chapter IV P (*Disposal*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	

	such a manner that achieves the performance objectives, consistent with the disposal facility PA?
	• Do additional requirements include:
	  • Operating procedures developed and implemented for LLW disposal facilities that protect the public, workers, and the environment; ensure the security of the facility; minimize subsidence during and after waste emplacement; achieve long-term stability and minimize the need for long-term active maintenance; and meet the requirements of the closure/post-closure plan?
	  • Permanent identification markers for disposal excavations and monitoring wells emplaced?
	  • LLW placement into disposal units to minimize voids between waste containers?
	  • Voids within disposal units filled to the extent practical?
	  • Un-containerized bulk waste placed in a manner that minimizes voids and subsidence?
	  • Operations conducted so that active waste disposal operations will not have an adverse effect on any other disposal units?
	• Operations include a process for tracking and documenting LLW placement in the facility by generator source?			

86	<u>Alternate Requirements for LLW Disposal Facility Design and Operation</u> If requirements, other than those specified in DOE O 435.1 and associated manual for the design and operation of a LLW disposal facility are implemented, are the alternate requirements approved on a specific basis, if a reasonable expectation is demonstrated that the disposal performance objectives will be met?	X	X	DOE-M 435.1-1, Chapter IV P (*Disposal*)
87	• Was a preliminary closure plan developed and submitted to Headquarters for review with the PA and CA? • Is the closure plan updated following issuance of the disposal authorization statement to incorporate conditions specified	X	X	• DOE-M 435.1-1, Chapter IV Q (*Closure*) • DOE O 458.1 *Radiation Protection of the Public and the Environment)*

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	in the disposal authorization statement? • Are closure plans updated as required during the operational life of the facility? • Do closure plans include a description of how the disposal facility will be closed to achieve long-term stability and minimize the need for active maintenance following closure and to ensure compliance with the requirements of DOE O 458.1? • Do closure plans include the total expected inventory of wastes to be disposed at the facility over the operational life of the facility? • Does closure of a disposal facility occurs within a five-year period after it is filled to capacity, or after the facility is otherwise determined to be no longer needed? Additionally: • Prior to facility closure, is the final inventory of the LLW disposed in the facility prepared and incorporated in the PA and CA when updated to support the closure of the facility? • Is a final closure plan prepared based on the final inventory of waste disposed in the facility, the plan implemented, and the updated PA and CA prepared in support of the facility closure? • Are institutional control measures integrated into land use and stewardship plans and programs, and continue until the facility can be released pursuant to DOE O 458.1? • Is the location and use of the facility documented and filed with the local authorities responsible for land use and zoning?			

88	• Are the following parameters sampled or monitored, at a minimum:
	  • Temperature?
	  • Pressure (for closed systems)?
	  • Radioactivity in ventilation exhaust and liquid effluent streams?
	  • Flammable or explosive mixtures of gases?
	• Do facility monitoring programs include verification that passive and active control systems have not failed?
			X	DOE-M 435.1-1, Chapter IV R (*Monitoring*)

LOI Set 19: Waste Management.				
	Waste Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• For facilities storing liquid LLW, are the following also monitored: liquid level and/or waste volume, and significant waste chemistry parameters?			
89	• For disposal facilities, is a preliminary monitoring plan for each LLW disposal facility prepared and submitted to Headquarters for review with the performance assessment and composite analysis? • Is the monitoring plan updated within one year following issuance of the disposal authorization statement to incorporate and implement conditions specified in the disposal authorization statement? • Is the site-specific PA and CA used to determine the media, locations, radionuclides, and other substances to be monitored? • Is the environmental monitoring program designed to include measuring and evaluating releases, migration of radionuclides, disposal unit subsidence, and changes in disposal facility and disposal site parameters which may affect long-term performance?		X	DOE-M 435.1-1, Chapter IV R (*Monitoring*)
90	Are environmental monitoring programs capable of detecting changing trends in performance to allow application of any necessary corrective action prior to exceeding the performance objectives?		X	DOE-M 435.1-1, Chapter IV R (*Monitoring*)

LOI Set 20: D&D Considerations During Design

Set 20: D&D Considerations During Design.				
	D&D Considerations Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Has the nuclear facility design incorporated features to facilitate safe deactivation, decommissioning, and decontamination at the end of facility life, including incorporation of design considerations during the operational period that facilitate future decontamination and decommissioning?	X		• DOE O 420.1B, Chapter I, Section 3.b.(5) • DOE G 420.1-1 Section 3.7
2	Has the facility design to facilitate deactivation by incorporating facility features that aid in the removal of surplus radioactive and chemical materials; storage tank cleanout and maintenance; stabilization of contamination and process materials; and the removal of hazardous, mixed, and radioactive wastes?	X		DOE G 420.1-1 Section 3.7
3	Have the following design principles been considered for decommissioning? • Use of localized liquid-transfer systems with emphasis on localized batch solidification of liquid waste to avoid long runs of buried contaminated piping. Special provisions should be included in the design to ensure the integrity of joints in buried pipelines. • Location of exhaust filtration components of the ventilation systems at or near individual enclosures to minimize long runs of internally contaminated ductwork. • Equipment, including effluent decontamination equipment that precludes, to the extent practicable, the accumulation of radioactive or other hazardous materials in relatively inaccessible areas, including curves and turns in piping and ductwork. Accessible, removable covers for inspection and cleanouts are encouraged. • Use of modular radiation shielding in lieu of or in addition to monolithic shielding walls. • Provisions for flushing and/or cleaning contaminated or potentially contaminated piping systems. • Provisions for suitable clearances, where practical, to accommodate remote handling and safety surveillance equipment required for future decontamination and decommissioning. • Use of lifting lugs on large tanks and equipment. • Piping systems that carry contaminated or potentially contaminated liquid should be free draining via gravity.	X		DOE G 420.1-1 Section 3.7

LOI Set 21: Systems Engineering

LOI Set 21: Systems Engineering.				
	Systems Engineering Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	For CD approval beginning in CD-1, is systems engineering being implemented for the integration of requirements analysis, risk identification and analysis, acquisition strategies, and concept exploration in order to evolve a cost-effective, preferred solution to meet a mission need?	X		• DOE O 413.3B, Appendix C, Section 4.b • DOE G 413.3-1, Section 4
2	Are systems engineering being implemented by the FPD and the IPT for the integration of preliminary design activities and for project oversight?	X		DOE G 413.3-1, Section 5
3	Are systems engineering being implemented for the overseeing and coordination of final design activities?	X		DOE G 413.3-1, Section 6
4	Are systems engineering being implemented for the overseeing and coordination of construction activities?	X		DOE G 413.3-1, Section 7
5	For nuclear facilities, are the following systems engineering activities being implemented? • identifying and integrating facility nuclear safety requirements; • coordinating multidisciplinary teamwork in implementing facility safety requirements; • providing nuclear safety-related interface management; • providing configuration management to include the establishment of baseline • configuration; and • coordinating technical reviews of the facility nuclear safety features.	X	X	DOE G 420.1-1, Section 2.4
6	Has a SEP been established for hazard category 1, 2, and 3 nuclear facilities and to ensure continued operational readiness of the systems? **Note:** The SEP Program must be applied to active safety class and safety significant structures, systems, and components (SSCs) as defined in the facility's DOE approved safety basis, as well as to other active systems that perform important defense-in-depth functions, as designated by facility line management.	X	X	• DOE O 420.1B, Chapter V • DOE-STD-1189-2008, Section 7.14

LOI Set 21: Systems Engineering.				
	Systems Engineering Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
7	Has a qualified cognizant system engineer been assigned to each system within the scope of the SEP?	X	X	DOE O 420.1B, Chapter V, Section 3.a
8	Have the SEP requirements: 1) been incorporated into the ISMS; 2) flow down from site and facility implementing procedures; and 3) defined the cognizant system engineer functions, responsibilities, and authorities?	X	X	DOE O 420.1B, Chapter V, Section 3.a
9	Is a graded approach used in applying the requirements of the SEP? **Note:** The Implementation of the SEP requirements should be tailored to facility hazards and the systems relied upon to prevent or mitigate those hazards. The graded approach should consider factors such as the remaining facility lifetime and the safety significance of remaining operations; and safety importance of the system. Consistency with the graded approach, large, complex, or very important systems may require assignment of more than one technical level CSE while small, simple, less important systems may only require assignment of a technician. Conversely, a single individual may be assigned to be the CSE for more than one system.	X	X	• DOE O 420.1B, Chapter V, Section 3.a • DOE O 420.1B, Chapter V, Section 3.e
10	Do the SEP elements include and integrate the identification of the systems, configuration management, and CSE support for operations and maintenance?	X	X	DOE O 420.1B, Chapter V, Section 3.b
11	Are the following Configuration Management13 (CM) requirements integrated into the SEP? • CM must be used to develop and maintain consistency among system requirements and performance criteria, documentation, and physical configuration for the SSCs within the scope of the process; • CM must integrate the elements of system requirements and performance criteria, system assessments, change control, work control, and documentation control; • System design basis documentation and supporting documents must be compiled and kept current using formal change control and work control processes or, when design basis	X	X	DOE O 420.1B, Chapter V, Section 3.c

[13]See Configuration Management LOIs.

LOI Set 21: Systems Engineering.				
	Systems Engineering Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	information is not available; • Key design documents must be identified and consolidated to support facility safety basis development and documentation; • System assessments must include periodic review of system operability, reliability, and material condition; • System maintenance and repair must be controlled through a formal change control process to ensure that changes are not inadvertently introduced and that required system performance is not compromised; and • Systems must be tested after modification to ensure continued capability to fulfill system requirements.			
13	Does the cognizant system engineer support for operations and maintenance: • ensure that system configuration is being managed effectively • remain apprised of operational status and ongoing modification activities; • assist operations review of key system parameters and evaluate system performance; • initiate actions to correct problems; • remain cognizant of system-specific maintenance and operations history and industry operating experience, as well as manufacturer and vendor recommendations and any product warnings regarding safety SSCs in their assigned systems; • identify trends from operations; • provide assistance in determining operability, correcting out-of-specification conditions, and evaluating questionable data; • provide or support analysis when the system is suspected of inoperability or degradation; • review and concur with design changes; and • provide input to development of special operating/test procedures? **Note:** The cognizant system engineer must maintain overall cognizance of the system and be responsible for system engineering support for operations and maintenance. The CSE must		X	DOE O 420.1B, Chapter V, Section 3.d

LOI Set 21: Systems Engineering.				
	Systems Engineering Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	provide technical assistance in support of line management safety responsibilities and ensure continued system operational readiness.			
14	Are the cognizant system engineer qualification requirements consistent with those defined for technical positions described in DOE O 426.2, Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities?		X	DOE O 420.1B, Chapter V, Section 3.d
15	Are the SEP requirements incorporated into the contractor training programs?		X	DOE O 420.1B, Chapter V, Section 3.d
16	Are the development plans for cognizant system engineers part of the overall training and development program?		X	DOE O 420.1B, Chapter V, Section 3.d
17	Do the cognizant system engineer qualification and training requirements include the following: • related facility safety basis including any relationship to specific administrative controls; • system functional classification and basis; • applicable codes and standards; • system design, procurement, replacement, and related quality assurance requirements; • the existing condition of the system; • a working knowledge of the facility's operation; and • vendor recommendations, manuals, and any product warnings?		X	DOE O 420.1B, Chapter V, Section 3.d
18	Does the evaluation of the cognizant system engineer's qualifications include formal education, prior training, and work experience?		X	DOE O 420.1B, Chapter V, Section 3.d

LOI Set 22: Configuration Management

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
Design				
1	If this is a new design/construction project, have DOE and the contractor agreed to the time frame for initiating a formal configuration control?	X		DOE-STD-1073-2003, Section 3.1.1
2	Were the design requirements identified and documented as part of the design process?	X		DOE-STD-1073-2003, Section 3.1.1
3	How is the stability of requirements flow-down managed? Are changes agreed to between upper and lower tiers? Are these changes and agreements documented?	X		• DOE O 420.1B • DOE O 413.3B • DOE-STD-1073-2003
4	Were the design requirements incorporated into a formal configuration management process before start of construction?	X		DOE-STD-1073-2003, Section 3.1.1
5	For an existing facility, are the identified design requirements adequate to ensure that SSCs will function as required in the DSA?	X		DOE-STD-1073-2003, Section 3.1.2
6	Once configuration management is implemented, has the contractor ensured that any design changes are controlled and the drawings and associated documents are updated to reflect the revised design?	X		DOE-STD-1073-2003, Section 3.2
7	Has the contractor identified an appropriate set of SSCs for control using the configuration management process?	X		DOE-STD-1073-2003, Section 3.2
8	For the identified systems, have system boundaries and component lists been established to accomplish the system's function and meet the system's design requirements?	X		DOE-STD-1073-2003, Section 3.2
9	Has the contractor identified and documented the design requirements for the identified SSCs? Are the identified design requirements adequate and appropriate?	X		DOE-STD-1073-2003, Section 3.3
10	Does documentation identify which design requirements are required for safety and which are necessary for cost, environmental, or other considerations, so the impacts of changes can be better assessed?	X		DOE-STD-1073-2003, Section 3.3
11	Do the design requirements identified in the documentation include those that affect: • Function,	X		DOE-STD-1073-2003, Section 3.3.

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Installation, • Performance, • Safety, • Operation, and • Maintenance?			
12	Is the identification of the design requirements clearly documented in the design process, including: • Design inputs, • Design constraints, and • Design analysis and calculations?	X		DOE-STD-1073-2003, Section 3.3.1
13	Do the design output documents include: • Design change packages and logs, • Drawings, • Specifications, • Load lists, • Valve lists, • Design (stress) reports, • One-line electrical drawings, and • Set point lists?	X		DOE-STD-1073-2003, Section 3.3.2
14	Has the contractor identified a Design Authority for each SSC?	X		DOE-STD-1073-2003, Section 3.5
15	When the design requirements were initially established, did the contractor perform a technical management review to evaluate the adequacy of the design requirements?	X		DOE-STD-1073-2003, Section 3.6
16	Did the review for technical adequacy consider: • Completeness, • Accuracy, and • the level of documentation?	X		DOE-STD-1073-2003, Section 3.6
17	Did the contractor retain and maintain the design review team's conclusions and the basis for the conclusions in a retrievable form?	X		DOE-STD-1073-2003, Section 3.6
18	If any deficiencies were identified in the technical review of the design requirements, were the items tracked and closed appropriately for the level of the issue identified?	X		DOE-STD-1073-2003, Section 3.6
19	Did the contractor develop a configuration management equipment database that cross references the SSCs with their design	X		DOE-STD-1073-2003, Section 3.8

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	requirements, design bases, key performance parameters, and associated documents?			
20	For a design/construction project, have the design and construction contractors agreed on formal criteria for construction turnover, such as: • Specify at design inception the format and content of design basis and design output documents, as well as software data management, to ensure that they will be compatible with the operating contractor's work processes, • Periodically monitor the preparation of design basis and design output documents, • Specify the review and approval process for the format and content of final design basis and final design output documents, and • Accept responsibility for their configuration management at turnover?	X		DOE-STD-1073-2003, Section 3.9
21	Did the contractor implement the graded approach for the application of configuration management for the SSCs?	X		DOE-STD-1073-2003, Section 3.10
22	Was the application of the graded approach based on items including: • Facility Hazard Category, • SSC Importance, • Facility type and technical characteristics, • Remaining facility lifetime, • Operation Status and lifecycle phase, • Programmatic and technical issues, and • Existing programs and procedures?	X		DOE-STD-1073-2003, Section 3.10
Work Control				
23	Does the contractor's work control process ensure that, when work activities are performed, consistency is maintained between the documents, the procedures, and the physical configuration of the facility?	X	X	DOE-STD-1073-2003, Section 4
24	Are the responsibilities, authorities and expectations of work control clearly communicated to all individuals who do work? Does a current Integrated Project Team (IPT) Charter clearly define such roles and responsibilities?	X	X	DOE-STD-1073-2003, Section 4
25	Does the work approval process by the authorized person ensure that the change control process,		X	DOE-STD-1073-2003,

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	including the USQ process, is used for changes that could impact the safety analysis or hazard controls?			Section 4
26	Does the work control process have a clearly defined process for field changes to ensure that configuration management expectations are met in execution of field work?	X	X	DOE-STD-1073-2003, Section 4
Change Control				
27	Has the contractor established and implemented a formal change control process as part of the configuration management process?	X	X	DOE-STD-1073-2003, Section 5
28	Does the change control process ensure: • Changes are identified and assessed through the change control process, • Changes receive appropriate technical, safety, and management review to evaluate the consequences of the change, • Changes are approved or disapproved, • Waivers and deviations are properly evaluated and approved or denied and the technical basis for the approval or the denial is documented, • Approved changes are adequately and fully implemented or the effects of the partial implementation are evaluated and accepted, • Implemented changes are properly assessed to ensure the results of the changes agree with the expectations, and • Documents are revised consistent with the changes and the revised documents are provided to users?	X	X	DOE-STD-1073-2003, Section 5
29	Does the change control process ensure that each proposed change to the facility, activity or operation is considered for processing through the control process?	X	X	DOE-STD-1073-2003, Section 5.1.1
30	Are all mechanisms identified and integrated in the change control process that can lead to temporary or permanent changes in the design requirements, the physical configuration or the documentation?	X	X	DOE-STD-1073-2003, Section 5.1.1
31	Has the contractor identified and implemented a process to consider the impact of minor changes? **Note:** As discussed in the standard, it is important to identify and consider subtle changes under the configuration management process. Changes that are perceived to be minor or insignificant can	X	X	DOE-STD-1073-2003, Section 5.1.2

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	significantly impact the functions of SSCs required to maintain safe operation or to achieve mission objectives. They can also result in operations outside the approved safety basis. A well-designed change control process should include a screening process to determine if seemingly insignificant changes should have at least a cursory review by an interdisciplinary group to confirm that there are no significant impacts from the proposed change. In addition, the contractor must ensure that the USQ process is invoked and applied to changes consistent with the requirements of 10 CFR Part 830 and the DOE-approved USQ process to maintain the integrity of the safety basis.			
32	Has the contractor identified and implemented a process to identify equivalent changes?	X	X	DOE-STD-1073-2003, Section 5.1.3
33	Have all personnel in design, operations and support organizations that do work for the facility or activity been trained on the change control process?	X	X	DOE-STD-1073-2003, Section 5.1.4
34	Are the forms and procedures used in the change control process easy to use and understand? Do they: • Facilitate complete and timely change identification and control, • Are they easy to use and encourage participants to use them, and • Do they provide for management tracking and reporting?	X	X	DOE-STD-1073-2003, Section 5.1.5
35	Has the contractor implemented a process for documenting proposed changes that includes: • A unique identifier for the proposed change, • A description of the proposed change sufficient to support technical, safety, and management reviews prior to approval, • The name and organization of the requestor, • A description of the potentially affected SSCs, • The reason for the proposed change, • A list of the alternative solutions considered and the results, • Cost/benefit analysis and documented schedule impacts, • The date by which the decisions about the change needs to be completed to facilitate	X	X	DOE-STD-1073-2003, Section 5.2.1

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	timely implementation or to allow implementation to occur concurrent with other activities such as a planned maintenance shutdown, • Constraints (including funding constraints), and • Any other information needed to review, track, approve or process the proposed change?			
36	Does the change control process require the design authority to prepare a change control package consistent with the design process and the controls for the proposed change?	X		DOE-STD-1073-2003, Section 5.2.2
37	Does the change control package include drawings, analysis, procedures, instructions and other documents needed to properly assess, implement, verify and validate the proposed change?	X		DOE-STD-1073-2003, Section 5.2.2
38	Does the change control process require a formal documented change control review for each proposed change?	X	X	DOE-STD-1073-2003, Section 5.3
39	Are design changes subject to the same level of management and technical review as applicable to the original design?	X		DOE-STD-1073-2003, Section 5.3
40	Does the technical review verify that: • The facility, activity, or operation will continue to operate safely and provide adequate protection to workers, the public and the environment, • The contractor's ability to continue to meet safety and environmental requirements, performance criteria, permit requirements or any other applicable state or Federal requirement is not negatively affected, • The mission can continue to be achieved, • The change will not create unacceptable maintenance problems, • The security of the facility or activity is not compromised, and • The safety basis is preserved or the changes to the safety basis are assessed and determined to be acceptable?	X	X	DOE-STD-1073-2003, Section 5.3.1
41	Does the required technical review include: • Design basis review, • Independent design verification, • Interdisciplinary technical reviews,	X	X	DOE-STD-1073-2003, Section 5.3.1

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Identification of affected hardware and documents, • Identification of post-implementation acceptance criteria, and • Other reviews as appropriate?			
42	Does the change control process ensure that, if the proposed change is not within the current design basis, a design analysis for the change is completed and approved?	X		DOE-STD-1073-2003, Section 5.3.1.1
43	Does the independent design verification process verify that: • Design inputs and constraints are correctly identified, • Design analyses and calculations are complete and correct, • Design outputs are complete and consistent, • Reasonable methods are used in the analysis, • System interactions are considered appropriately, and • Appropriate post-modification testing and acceptance criteria are established?	X		DOE-STD-1073-2003, Section 5.3.1.2
44	Does the change control process ensure that all affected documents for a proposed change are identified and modified as required to support the change?	X	X	DOE-STD-1073-2003, Section 5.3.1.4
45	Does the change control process require the identification of acceptance/test criteria for the proposed change prior to acceptance of the modified SSC by the operating organization?	X	X	DOE-STD-1073-2003, Section 5.3.1.5
46	Does the change control process ensure that a management review/verification of proposed changes is performed? Management review/verification may consider: • Whether the benefits of the change warrant the cost and schedule impacts, and • The source of funding to complete the change	X	X	DOE-STD-1073-2003, Section 5.3.2.1 and Section 5.3.2.2
47	Does the configuration management process specifically state that the DOE-approved USQ procedure must be consulted for all proposed changes and implemented whenever required by the 10 CFR Part 830 or the DOE-approved USQ process?		X	DOE-STD-1073-2003, Section 5.3.3

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
48	Does the change control process ensure the following reviews: • Cost and benefit review, • Reviews required by regulatory and contract requirements, and • Review of the impact on the operations schedule?	X	X	DOE-STD-1073-2003, Section 5.3.4
49	Does the change control process clearly identify the approval authority for the change?	X	X	DOE-STD-1073-2003, Section 5.4
50	Does the change control process ensure that changes are reviewed, approved, verified and validated by appropriate personnel with authorities and responsibilities before they are implemented?	X	X	DOE-STD-1073-2003, Section 5.5.1
51	Prior to implementation of the change, is the change control package reviewed to ensure that: • It is complete and usable, • There are no unidentified physical interfaces, • The change is likely to meet defined post-implementation acceptance criteria, and • The change has been approved for implementation?	X	X	DOE-STD-1073-2003, Section 5.5.2
52	Do the change control packages: • Identify all deviations from current design requirements so that the changes are tracked and documented, • Identify all documents that need to be revised consistent with the approved change, • Define and notify the authorities and responsibilities associated with the approved change, • Identify the work processes to be used to implement the change, and • Identify any constraints to the implementation process?	X	X	DOE-STD-1073-2003, Section 5.5.2
53	Does the change control process ensure that changes made are consistent with the approved change package (or as modified by an approved field change)?	X	X	DOE-STD-1073-2003, Section 5.5.3
54	Does the change control process provide means to track the changes to completion?	X	X	DOE-STD-1073-2003, Section 5.5.4
55	Does the change control/work control process identify a means for partial change implementation	X	X	DOE-STD-1073-2003, Section 5.5.6

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	that ensures that the partial implementation is approved and implemented correctly?			
56	Does the change control process have a means to identify and consider the implementation of multiple changes in parallel to ensure that they maintain the facility safety and controls?	X	X	DOE-STD-1073-2003, Section 5.5.7
57	Does the change control process ensure that post-modification testing is performed and that the results are determined to be acceptable before the modified SSC is accepted by the operating organization?	X	X	DOE-STD-1073-2003, Section 5.6
58	Does the change control process ensure that all affected personnel receive training, as appropriate, for the implementation of a change package?	X	X	DOE-STD-1073-2003, Section 5.7
59	Does the change control process ensure that all documents requiring modification based on a change package are updated and released before the change is completed and closed out?	X	X	DOE-STD-1073-2003, Section 5.8
60	Does the contractor refer to their contracts and DOE O 413.3B for possible requirements related to changes to project and capital assets?.	X		DOE-STD-1073-2003, Section 5.11
Document Control				
61	Does the document control process ensure that each updated document is uniquely identified and includes a revision number and a date and that only the current revision is used in work execution?	X	X	DOE-STD-1073-2003, Section 6
62	Does the document control process identify the documents that need to be controlled?	X	X	DOE-STD-1073-2003, Section 6.1
63	Does the document control process specify storage of documents so they are retrievable?			DOE-STD-1073-2003, Section 6.2
64	Does the document control process specify that the contractor should develop and implement procedures for specifying document identification, control, storage, and retrieval requirements?	X	X	DOE-STD-1073-2003, Section 6.3.1
65	Does the document control process specify that the contractor should establish and maintain a secure master file of the original documents or master copies?			DOE-STD-1073-2003, Section 6.3.2
66	Does the document control process provide for the distribution of changes to all the affected and appropriate personnel for review, approval, and for implementation (including those with authorities and responsibilities)?	X	X	DOE-STD-1073-2003, Section 6.3.3

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
67	Does the document control process specify that the organization responsible for document control should notify any need to change a document as soon as that need is identified and approved?	X	X	DOE-STD-1073-2003, Section 6.3.4
68	Does the document control process provide for the identification of minor changes and a graded process for the implementation of these changes?	X	X	DOE-STD-1073-2003, Section 6.3.5
69	Does the document control process specify that the organization responsible for document control should provide notice of pending changes to the controlled document users for the applicable documents?	X	X	DOE-STD-1073-2003, Section 6.3.6
70	Does the document control process specify that the contractor should incorporate the approved changes into controlled documents in a timely manner?	X	X	DOE-STD-1073-2003, Section 6.3.7
71	Does the change control process specify that the contractor organization responsible for document control should send a copy of the new revision to each controlled document user of the document, along with a request for written receipt acknowledgment?	X	X	DOE-STD-1073-2003, Section 6.3.8
72	Does the change control process specify measures to ensure that superseded or canceled documents are replaced?	X	X	DOE-STD-1073-2003, Section 6.3.9
73	Does the change control process include a database for tracking document status and pending changes?	X	X	DOE-STD-1073-2003, Section 6.3.10
74	Does the change control process specify that the contractor should establish a maximum retrieval time for each document based upon priorities by the document owners and users?	X	X	DOE-STD-1073-2003, Section 6.4
75	Does the change control process specify that the contractor should define the interfaces among facility, maintenance, and non-facility organizations to ensure configuration-related information is completely and accurately communicated?	X	X	DOE-STD-1073-2003, Section 6.5
76	Does the change control process specify that the contractor must review all changes for their potential impact on the PDSA, following the submittal of the PDSA to DOE?	X		DOE-STD-1073-2003, Section 6.6
77	Does the change control process specify that the PDSA should be maintained up-to-date as the design evolves?	X		DOE-STD-1073-2003, Section 6.6

LOI Set 22: Configuration Management.				
	Configuration Management Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
Configuration Management Assessments				
78	Does the configuration management assessment process ensure that personnel performing the assessments have sufficient authority and freedom from line management and are qualified to perform the assessments?	X	X	DOE-STD-1073-2003, Section 7
79	For construction assessments, have DOE and the contractor formally agreed on the point when the configuration management process will be imposed and what process will be used?	X		DOE-STD-1073-2003, Section 7.2
80	Is there a documented plan for configuration management during construction?	X		DOE-STD-1073-2003, Section 7.2
81	Is there a strategy established for physical configuration assessments to determine if the actual physical configuration agrees with the design requirements and documentation?	X		DOE-STD-1073-2003, Section 7.3
82	Does the contractor perform design assessments to determine the consistency among the documented design and system requirements, the system documentation, and the physical configuration of the facility?	X		DOE-STD-1073-2003, Section 7.4
83	Following completion of construction or major facility modification, does the contractor perform inspections and tests to verify expected operation?	X		DOE-STD-1073-2003, Section 7.5
84	For periodic performance assessments, has the contractor developed and implemented a Maintenance Implementation Plan?	X	X	• DOE-STD-1073-2003, Section 7.6, • DOE G 433.1-1, Nuclear Facility Maintenance Management Program Guide for Use with DOE O 433.1
85	Has the contractor established a formal, documented process for resolution of open items?	X	X	DOE-STD-1073-2003, Section 7.7
86	Does the contractor assessment process review requirements flow-down and ensure that changes in requirements from upper tier to lower tier contractors are approved by DOE and documented?	X		• DOE O 420.1B, • DOE O 413.3B • DOE-STD-1073-2003

LOI Set 23: Nuclear Maintenance Management Program

LOI Set 23: Nuclear Maintenance Management Program				
	Nuclear Maintenance Management Program Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1	Is the maintenance of the SSCs conducted under an approved NMMP for HC 1, 2, and 3 nuclear facilities?	X	X	• DOE O 433.1B, Section 4 • DOE O 433.1B, Attachment 2
2	Is the NMMP in compliance with the requirements contained in the CRD? Has it been approved by the Field Office Manager and SO?	X	X	• DOE O 433.1B, Section 4 • DOE O 433.1B, Attachment 1 • DOE O 433.1B, Attachment 2
3	Are the CRD requirements flowed down from the contractor to the subcontractors?	X	X	DOE O 433.1B, Attachment 1
4	Is the NMMP approved prior to startup of new hazard category 1, 2, and 3 nuclear facilities and at least every three years for all hazard category 1, 2, and 3 nuclear facilities?	X	X	DOE O 433.1B, Section 4
5	Are changes to the NMMP reviewed under the USQ process to ensure that SSCs are maintained and operated within the approved safety basis?	X	X	• DOE O 433.1B, Section 4 • DOE O 443.1B, Attachment 2
6	Are changes, which would result in unreviewed safety question approval, done prior to the change taking effect?	X	X	DOE O 433.1B, Section 4
7	Are assessments of NMMP implementation conducted at least every three years, or more frequently if directed by the SO in accordance with DOE O 226.1A?	X	X	• DOE O 433.1B, Section 4 • DOE O 433.1B, Attachment 2
8	Are periodic self-assessments conducted in accordance with DOE O 226.1A to evaluate the effectiveness of oversight of the NMMP?	X	X	DOE O 433.1B, Section 4
9	Does a single maintenance program address the requirements of DOE O 433.1B and DOE O 430.1B?	X	X	DOE O 433.1B, Section 4
10	If the DOE O 433.1B requirements have not been fully implemented within 1 year of its issuance (April 21, 2010), has the SO approved a different implementation schedule with concurrence from the CTAs?	X	X	DOE O 433.1B, Section 4
11	Does the NMMP describe the safety management program for maintenance and	X	X	DOE O 433.1B,

LOI Set 23: Nuclear Maintenance Management Program				
	Nuclear Maintenance Management Program Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	reliable performance of the SSCs which are part of the facility safety basis?			Attachment 2
12	Have the Federal and contractor organizations ensured that equivalencies and exemptions from the DOE O 433.1B requirements been identified, formally documented with supporting justification, and approved in accordance with DOE O 251.1C? Has concurrence requested from the CTA or designee been accomplished for both exemptions and equivalencies?	X	X	DOE O 433.1B, Attachment 2
13	Have the Federal and contractor organizations implemented the NMMP through federal or contractor-approved documents, such as with a manual or a set of implementing procedures?	X	X	DOE O 433.1B, Attachment 2
14	Does the NMMP description documentation contain, at a minimum, an applicability matrix or a combination of multiple documents? Does the NMMP cover: (1) Correlation of the requirements in DOE O 433.1B Attachment 2 to the applicable facilities, (2) Correlation of the implementing documents (i.e., procedures, work instructions, etc.) to the specific requirements in Attachment 2, and (3) Documentation of the basis for applying a graded approach, if applicable?	X	X	DOE O 433.1B, Attachment 2
15	Have the Federal and contractor organizations, with previously approved maintenance management program documentation, submitted either an addendum or page changes to the program documentation to reflect the changes made as a result of the implementation of DOE O 433.1B requirements?	X	X	DOE O 433.1B, Attachment 2
16	If no changes are needed, has a memorandum to that effect been submitted as the addendum? **Note:** Changes must be submitted to DOE/NNSA for approval within 90 days from the date of inclusion of the requirements in this attachment in the contract.	X	X	DOE O 433.1B, Attachment 2
17	Have the Federal and contractor organizations ensured that the NMMP has been identified in the applicable DSA in accordance with 10 CFR 830.204?	X	X	DOE O 433.1B, Attachment 2
18	When reviewing the specific NMMP documentation, are the following topics addressed?	X	X	DOE O 430.1B, Chg 2, Attachment 2, Specific Requirements

LOI Set 23: Nuclear Maintenance Management Program				
	Nuclear Maintenance Management Program Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	• Integration with Regulations, DOE Orders and Manuals (and their CRDs) • Maintenance Organization and Administration • Master Equipment List • Planning, Scheduling, and Coordination of Maintenance • Types of Maintenance • Maintenance Procedures • Training and Qualification • Configuration Management • Procurement • Maintenance Tool and Equipment Control • Suspect and Counterfeit Items • Maintenance History • Aging Degradation and Technical Obsolescence • Seasonal Facility Preservation • Performance Measures • Facility Condition Inspection • Post Maintenance Testing			
19	Does the NMMP include a condition assessment of the real property assets, work control system, management of deferred maintenance, method to prioritize, and systems to budget and track maintenance expenditures?	X	X	DOE O 430.1B, Chg 2, Attachment 2, Contract Requirements Document
20	Does the NMMP identify the 5-year maintenance and repair requirements (sustainment) and funding for deferred maintenance reduction?	X	X	DOE O 430.1B, Chg 2, Attachment 2
21	Does the NMMP identify 5-year recapitalization requirements to replace or modernize existing facilities?	X	X	DOE O 430.1B, Chg 2, Attachment 2
22	Is a condition assessment performed on real property assets at least once within a five-year period (this may be required more frequently for mission-essential facilities and infrastructure)? Note: The condition assessment program shall utilize a graded approach based on facility status, mission and importance and the magnitude of the hazards associated with facilities and infrastructure. Inspection	X	X	DOE O 430.1B, Chg 2, Attachment 2

LOI Set 23: Nuclear Maintenance Management Program				
	Nuclear Maintenance Management Program Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
	methodology shall be consistent with industry practice, and shall include identification of safety and health hazards. Deferred maintenance estimates will be based on nationally recognized cost estimating systems or the DOE Condition Assessment Information System (CAIS). The condition assessment program will support the reporting requirements of FIMS.			

LOI Set 24: Layout

LOI Set 24: Layout.				
	layout Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1 (30%)	Are the facility plot plans completed?	X		BEP
2 (30%)	Have layout alternatives been studied to prevent cascading effects from accidents (fire, explosions, releases, etc.)?	X		BEP
3 (30%)	Have alternatives been studied to provide inspection and maintenance access?	X		BEP
4 (30%)	Does the layout account for control room habitability following design-basis postulated accidents?	X		BEP
5 (30%)	Does the layout account for access for operator actions?	X		BEP
6 (30%)	Does the layout account for access for maintenance activities (cranes, pulling heat exchanger bundles, replacing pumps, etc.)?	X		BEP
7 (30%)	Are pumps, valves, compressors, fans grouped and accessible?	X		BEP
8 (30%)	Are pipe routings along the primary directions (east-west and north-south)?	X		BEP
9 (60%)	Are road crossings minimized, and sized to permit expected traffic?	X		BEP
10 (60%)	Are fire barriers provided where required?	X		BEP
11 (60%)	Is access for fire-fighters and emergency response included in the design?	X		BEP
12 (60%)	Are barriers provided to prevent accidental vehicle impact with SSCs?	X		BEP
13 (30%)	Are the civil-structural drawings of buildings completed?	X		BEP
14 (30%)	Are the civil-structural drawings of steel structures completed?	X		BEP
15 (30%)	Are orthographic drawings of major equipment layout completed?	X		BEP
16 (30%)	Is there a 3-D solid model of the facility?	X		BEP
17	Is the civil-structural constructability review	X		BEP

LOI Set 24: Layout.				
	layout Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
(30%)	completed?			
18 (60%)	Are isometrics for piping completed?	X		BEP
19 (60%)	Are isometrics for ducting completed?	X		BEP
20 (60%)	Are the electrical and wiring diagrams completed?	X		BEP
21 (60%)	Are orthographics or isometrics for cable trays completed?	X		BEP
22 (60%)	Are interferences and constructability of mechanical and electrical equipment and distribution systems completed?	X		BEP
23 (30%)	Are storage areas and environments compatible with the materials stored?	X		BEP
24 (30%)	Does the layout minimize and provide protection for the receipt, handling, and intra-area transport of hazardous materials?	X		BEP
25 (60%)	Are there open ditches, trenches where toxic or flammable vapors could collect?	X		BEP
26 (30%)	Does the layout account for security provisions?	X		BEP
27 (30%)	Is the potential for future expansion accounted for in the layout?	X		BEP
28 (60%)	Do the layout elevations provide for the required slope of lines?	X		BEP

LOI Set 25: Materials and Corrosion

LOI Set 25: Materials and Corrosion				
	Materials and Corrosion Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
1 (30%)	Are the fluids and their corrosivity defined for each basic process system and subsystem?	X		BEP
2 (30%)	Are the fluids and their corrosivity defined for each support and utility process system and subsystem?	X		BEP
3 (30%)	Are the operating conditions (max.-min. flow rates, including stagnant conditions, pressures, temperatures) defined for each fluid in the basic systems and subsystems?	X		BEP
4 (60%)	Are the operating conditions (flow rates (max.-min. including no flow regimes), pressures, temperatures) defined for each fluid in the support and utility systems and subsystems?	X		BEP
5 (30%)	Are the ambient environmental conditions defined for normal operation and postulated accidents, for each area of the facility (humidity, temperature, chemistries, radiation, etc.)?	X		BEP
6 (30%)	Are metallic materials and weld metals selected on the basis of extensive successful experience in identical conditions, for the same design life?	X		BEP
7 (60%)	Are non-metallic materials selected on the basis of extensive successful experience in identical conditions, for the same design life?	X		BEP
8 (30%)	For the basic process systems, have all damage mechanisms been evaluated on a subsystem basis: wall thinning (erosion-corrosion), cracking (corrosion, fatigue), embrittlement (hydrogen, radiation, high temperature, low temperature, etc.)?	X		BEP
9 (60%)	For the secondary and utility systems, have all damage mechanisms been evaluated on a subsystem basis: wall thinning (erosion-corrosion, MIC), cracking (corrosion, fatigue), embrittlement (hydrogen, radiation, high temperature, low temperature, etc.)?	X		BEP
10 (30%)	If identical environments are lacking, have simulation tests been conducted successfully in accordance with ASTM or NACE standards?	X		BEP
11 (30%)	For the basic process systems, have the inner linings or outer coatings proven for identical service and design life?	X		BEP
12 (60%)	If there is a need to monitor the material in service, are arrangements in place for periodic inspection and replacements.	X		BEP

LOI Set 25: Materials and Corrosion				
	Materials and Corrosion Lines of Inquiry (LOI)	Applicability		Reference
		Design	Operations & Disposition	
13 (60%)	Have there been alternative life-cycle cost studies for costly alloys?	X		BEP
14 (30%)	Are the welding processes standard for all materials selected?	X		BEP
15 (60%)	Is there a need for in-service chemistry controls, and is it reflected in the system design?	X		BEP
16 (60%)	Are the physical properties of the material (strength, hardness, toughness, elasticity, etc.) compatible with the range of operating conditions, accidents, and environments?	X		BEP
17 (30%)	Have industry and complex-wide lessons learned been studied to support material selection?	X		BEP
18 (30%)	Has material selection been reviewed with construction for feasibility of procurement, fabrication, erection?	X		BEP
19 (60%)	Are materials and weldments compliant to the design codes?	X		BEP
20 (60%)	Are selected joining techniques (welding, flange, couplings, etc.) compatible with the service?	X		BEP
21 (60%)	Are selected joining techniques (welding, flange, couplings, etc.) compatible with inspection and maintenance access?	X		BEP
22 (30%)	Is the design life of each basic process system, subsystem, component, defined, and if less than the facility design life, are there access provisions in the design for replacement?	X		BEP

Appendix B Abbreviations and Acronyms

Abbreviations and Acronyms

AEGL	Acute Exposure Guideline Level
ALARA	As Low As Reasonably Achievable
ANS	American Nuclear Society
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ANSI	American National Standards Institute
BEP	Best Engineering Practice
CA	Composite Analysis
CAS	Criticality Alarm System
CD	Critical Decision
CDR	Conceptual Design Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGD	Commercial Grade Dedication
CM	Configuration Management
CNS	Chief of Nuclear Safety
COR	Code of Record
CPR	Construction Project Review
CRD	Contractor Requirements Document
CSDR	Conceptual Safety Design Report
CSE	Criticality Safety Engineer
CSR	Criticality Safety Representative
CTA	Central Technical Authority
DA	Design Authority
DBA	Design Basis Accident
DBFL	Design Basis Flood
DBT	Design Basis Threat
DCS	Distributed Control System
DID	Defense-In-Depth
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DSA	Documented Safety Analysis
D&D	Deactivation, Decontamination and Decommissioning
EAL	Emergency Action Level
EISA	Energy Independence and Security Act
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EM	Office of Environmental Management
EO	Executive Order
EPA	Environmental Protection Agency

Abbreviations and Acronyms

EPHA	Emergency Planning Hazards Assessment
EPZ	Emergency Planning Zone
ERAP	Emergency Readiness Assurance Plan
ERPG	Emergency Response Planning Guideline
ES&H	Environment, Safety and Health
FHA	Fire Hazard Analysis
HFE	Human Factors Engineering
HPSB	High Performance and Sustainable Building
FPD	Federal Project Director
FW	Facility Worker
HA	Hazard Analysis
HAZWOPER	Hazardous Waste Operations and Emergency Response Program
HC	Hazard Category
HEPA	High Efficiency Particulate Air
HFE	Human Factor Engineering
HLW	High Level Waste
HPSB	High Performance and Sustainable Building
HVAC	Heating, Ventilation, and Air Conditioning
IAEA	International Atomic Energy Agency
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
IPT	Integrated Project Team
ISMS	Integrated Safety Management System
ISO	International Organization for Standardization
JIC	Joint Communication Center
LEED	Leadership in Energy and Environmental Design
LOI	Line of Inquiry
LLW	Low Level Waste
MAR	Material At Risk
MPFL	Maximum Possible Fire Loss
MSDS	Material Safety Data Sheets
NCS	Nuclear Criticality Safety
NEHRP	National Earthquake Hazard Reduction Program
NEPA	National Environment Policy Act
NFPA	National Fire Protection Association
NICET	National Institute for Certification in Engineering Technologies
NQA	Nuclear Quality Assurance
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
NMMP	Nuclear Maintenance Management Program
NPH	Natural Phenomena Hazard

Abbreviations and Acronyms

PA	Performance Assessment
PC	Performance Category (Seismic)
PDSA	Preliminary Documented Safety Analysis
PSDR	Preliminary Safety Design Report
PSO	Program Secretarial Office
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RGD	Radiation Generating Device
RPP	Radiation Protection Program
SAAB	Safety Basis Approval Authority
SAC	Specific Administrative Control
SC	Safety Class
SDC	Seismic Design Criteria
SDS	Safety Design Strategy
SEP	System Engineer Program
SIL	Safety Integrity Level
SIS	Safety Instrumented System
SO	Secretarial Officer
SRP	Standard Review Plan
SS	Safety Significant
SSC	Structures, Systems and Components
TDP	Technology Development Plan
TEDE	Total Effective Dose Equivalent
TEEL	Temporary Emergency Exposure Limit
TL	Threat Level
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
TRU	Transuranic Waste
TMP	Technology Maturation Plan
UL	Underwriters Laboratories
USDA	U.S. Department of Agriculture
USQ	Unreviewed Safety Question
WAC	Waste Acceptance Criteria
WIR	Wastes Incidental to Reprocessing