

Ownership matrix	RPP-27195
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1.0 PURPOSE AND SCOPE

This guidance document provides the tools and methodology for performing Project Design Reviews (PDRs) in accordance with TFC-ENG-DESIGN-C-52. PDRs are formal design reviews. Design reviews performed in accordance with this guidance are intended for the purpose of monitoring the status of in-process designs and **not** to perform design verification. Design verification is performed in accordance with TFC-ENG-DESIGN-P-17 only. This guidance shall be used in accordance with Attachment C of TFC-ENG-DESIGN-C-52. Final design deliverables from subcontracted engineering services vendors (Architect-Engineers [A-Es]) are reviewed in accordance with TFC-ENG-DESIGN-C-52, Section 4.8.

This guidance is not necessarily intended to apply to DOE O 413.3B, “Program and Project Management for the Acquisition of Capital Assets,” projects, although some concepts are similar and may be helpful to consider.

While the engineering checkers and the design verification process evaluate the technical accuracy and proper translation of design inputs into the design documents, the design review process described herein is an evaluation of the overall/integrated design progress to help ensure:

- Requirements are complete and sufficiently mature for the stage of the project
- To the extent appropriate for each review stage, design outputs align with project input requirements (via the Design Requirements Compliance Matrix [DRCM] in accordance with TFC-ENG-DESIGN-C-42, if available; Design Types 1 and 2 are required to include DRCMs)
- Design optimization principles have appropriately been considered
- Key process and operational issues are identified and being adequately addressed
- Quality, Safety, Health, and Environmental issues are addressed
- Technical risks, issues, and assumptions are identified and being adequately addressed
- At-risk practices are avoided (i.e., being unaware of critical attributes/parameters, ignoring subtle differences or apparently minor inconsistencies) during critical stages of the project.

The review will provide an independent assessment of the design, not verification or a redesign. Typically, this review will be a strategic/high-level review to identify project direction issues versus redundant reviews of design calculations and details. The review is not meant to duplicate informal project team reviews, drafting checks, engineering checks, or design verification. The philosophy can also be applied to only a portion of a project that contains the highest level of complexity, uncertainty, etc., and not to portions of the design that have limited cost, project risk, and complexity impact.

Another focus of the review is to evaluate whether the most economical design has been used to safely meet performance requirements, while minimizing the risk of failure. Attributes to consider include appropriate material selection, integrated design methodologies, use of design optimization software, etc. PDRs shall be performed at each phase of design (e.g., 30%, 60%,

90%), as applicable. The design review for subsequent phases of design must consider comments from previous phases.

The apportioning of the reviews to 30-60-90 percent is not required, but is highly recommended – especially for complex designs. The project team leadership should determine the appropriate review phases based on complexity and duration of the design. For instance, shorter duration projects may opt for 50-90. The most important consideration for phased reviews is to ensure outstanding comments are documented and carried over from phase to phase. Note that when using Attachment B, 30%, 60%, and 90% roughly correspond to Conceptual, Preliminary, and Final Design.

This guidance can be used for the review of designs for new tank farm structures, systems, or components (SSCs) and modification to existing SSCs.

2.0 IMPLEMENTATION

This guidance document is effective on the date shown in the header. Formal design reviews in progress at the time of issue should follow this guidance to the extent that the changes do not adversely impact project schedule or cost as determined by the project manager in conjunction with the assigned project engineer.

3.0 RESPONSIBILITIES

3.1 The PDR Team Lead

- Identifies the depth and scope of the PDR evaluations for the project.
- Appoints the PDR Coordinator (sometimes referred to as the Secretary).
- Selects PDR team members.

3.2 Project Engineering Manager

- Determines the need for PDR.
- Assigns the PDR Team Lead and ensures the PDR Team Lead is qualified.

3.3 PDR Team Members

- Perform the review.
- Should not have been involved in development or preparation of the design.
- Should be qualified via experience, training, and/or education as determined by Engineering management.

3.4 Design Authority/Project Engineer

- Determines when task documents will be available for review.
- Notifies the PDR Team when task documents are ready.
- Prepares presentation packages to support the PDR.

3.5 PDR Coordinator

- Issues announcement memo/email, including PDR scope, schedule, and participants to all stakeholders.
- Schedules and conducts orientation meeting.
- Arranges times/locations for subsequent meetings (e.g., review meetings, comment resolution meetings, report out meetings, closure meeting).

4.0 GUIDANCE

4.1 Design Review Scheduling

Design Authority/ Project Engineer	1.	When a contract for A-E design is placed, or in-house design services are selected, schedule and conduct “kick-off” and follow-on meetings with the design agent in accordance with guidance in Attachment A.
	2.	Confirm design deliverables during the design agency kick-off and follow-on meetings in accordance with the guidance in Attachment B.
Project Engineering Manager	3.	Determine the need for PDRs and ensure they are included in the Field Execution Schedule.

4.2 Preparation for Design Reviews

Design Authority/ Project Engineer	1.	If a PDR was performed at an earlier stage (e.g., 30% or 60%), ensure all comments were resolved satisfactorily, or captured in the open review comments list before continuing.
	2.	Request the Project Engineering Manager to assign a PDR Team Lead.

NOTE: The review team membership should include representatives of the organizations that are responsible for construction and operation of the SSCs being designed. No more team members than is necessary should be selected.

Additional team members may include:

- Design customer/project manager
- Project engineer
- Engineering discipline lead
- Discipline Engineering Group Lead (or delegate)
- Quality Assurance
- Nuclear Safety
- Operations
- Maintenance
- Construction & Commissioning management
- Safety
- Environmental

- Personnel responsible for interfacing systems
- Testing
- Process Engineer
- RadCon Engineer
- Fire Protection Engineer.

- PDR Team Lead
3. Select design review team members in conjunction with the project manager and project engineer.
 - a. Identify the design review team members by name before convening the initial design review meeting.

NOTE: The PDR Coordinator can be any person of the review team or an independent person selected by the PDR Team Lead. The PDR Team Lead may self-perform this function.

4. Appoint a PDR Coordinator for the design review meeting.

NOTE 1: Checklist items mentioned in the next step may be applicable items from Attachment C, project specifications, engineering standards, etc., that address the purpose (see Section 1.0) of the design review.

NOTE 2: A graded approach should be used to determine the adequacy of the review, dependent upon the cost and complexity of the design.

- Design Authority/
Project Engineer
5. Develop a design review checklist with the PDR Team Lead.

NOTE: The package mentioned in the next step must include a copy of any review comments listed from previous review meetings, and the list must indicate the status of the incorporation of comments.

6. Assemble a design review package, including all applicable material needed to perform the review (e.g., DRCMs, review checklists, drawings, calculations, specifications, technical basis, previous design phase review reports, and other design documentation).
7. Provide the assembled review package to the PDR Team Lead.

NOTE: The design package mentioned in the next step should include a list of specific assignments and required deliverables for each review team member and should include the project requirements matrix. This is an opportunity for the PDR Team Lead to focus reviewers on specific areas of expertise.

- PDR Team Lead
8. Issue the design package to the review team members prior to the design review meeting (this can be accomplished via email, or hard copies in a preliminary review team meeting, if desired).

NOTE: Reviewers should be prepared to present and defend comments at the review meeting. Reviewers should also consider comments from previous design review phases (e.g., 30% or 60%) as applicable.

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| PDR Team | <p>9. Review the design documents prior to the design review meeting.</p> <p>NOTE: To ensure adequate resolution, comments should be entered into SmartPlant Foundation (SPF) or submitted via Review Comment Record (RCR) form (A-6005-747) rather than only noted on the design media or sent by email.</p> <p>10. Prepare comment sheets on the design documents prior to the meeting.</p> <p style="padding-left: 40px;">a. Document comments in SPF, enter them on an RCR (A-6005-747), or note them on the design media.</p> <p>11. If possible, forward the review comments to the PDR Team Lead prior to the scheduled review meeting.</p> |
| PDR Team Lead | <p>12. Prepare and communicate an agenda for the design review meeting to the respective design review team members.</p> <p>13. Arrange the review meeting and room, and schedule all review team members.</p> |

4.3 Conduct of Project Design Review

Presenters at review meetings should be knowledgeable enough or subject matter experts should attend to answer any and all questions related to the design, including the bases for requirements, criteria, and design decisions made.

This process includes the development of a review comment listing. The review comment list is distributed to all reviewers.

NOTE: The PDR Team Lead or Coordinator should advise the PDR team members to review this section of this guidance document to become familiar with the process and expectations, particularly the note prior to step 7.

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|---------------------------------------|--|
| PDR Coordinator | 1. Schedule and convene a PDR meeting when requested by the Design Authority/Project Engineer. |
| Design Authority/
Project Engineer | <p>2. Chair the PDR meeting.</p> <p>3. Provide a briefing on the overall scope and description of the design intent, identification of the specific design package(s) to be reviewed, the stage of completion, test results, procurement issues, and any outstanding design “HOLDS” and “To Be Determined” items (TBDs).</p> |
| PDR Coordinator | 4. Provide a synopsis of the results of reviews at earlier stages of the design, as applicable. |

- a. Identify the status of any outstanding actions from prior reviews and the person(s) responsible for completion of the actions.
- Design Authority/
Subject Matter
Experts
- 5. Present the design approach and specifics of the design to the PDR team.
- PDR Team Lead
- 6. Lead a discussion/resolution of the consolidated comments.
 - a. Maintain focus.
 - b. Achieve comment/response concurrence.
 - c. Limit discussion to constructive exchanges of information.
 - d. Ensure review comments for future design stages are identified.
 - e. Ensure development of the Team’s PDR Conclusion.

NOTE: Should a review team member provide no response to the PDR Team Lead by close of business of the submittal date, and unless extensions have been requested and granted, then it may be assumed that the PDR team member has no comments. This should be documented in the meeting minutes by the PDR Coordinator. If comments are received after that date, only those comments indicating where the design does not meet specific scope, criteria, or requirements should be addressed.

- 7. Prepare comment sheets on the design documents.
 - a. Document comments should be entered directly in SPF, into an RCR (A-6005-747), or noted on the design media.

NOTE: Comments that do not require further analysis should be resolved during the meeting.

- 8. Attempt to resolve as many comments as possible during the meeting.

NOTE: Only comments transmitted to the Project Engineer become formal comments requiring a formal response.

- PDR Team Lead/
PDR Coordinator
- 11. Consolidate the comments from the review team members.
- Project Engineering
Manager
- 12. Enforce timely submittal of comments.

NOTE 1: Agreement between the Design Authority, PDR Team Lead, Coordinator, and respective PDR team members should be obtained prior to eliminating comments from the PDR.

NOTE 2: Comments requesting additional alternative study or redesign are to be evaluated by the PDR Team Lead and PDR team members for technical basis.

- If the comment is judged to be an improvement above minimum requirements, then an information copy is sent to the Project Manager.
- If the comment is judged to be a valid issue, it is submitted as a formal comment.

PDR Team Lead /
PDR Coordinator /
Design Authority

13. Screen the review comments for comments that are:

- Duplicates and/or out of scope
- Vague or inappropriate (originator should be contacted for revision or cancellation).

Design Authority/
Design Agent

14. Generate responses to all formal comments on the review comments.

PDR Coordinator

15. Convene a design review comment resolution meeting.

- a. Ensure responses to all PDR Team formal comments are RECEIVED by all PDR team members at least two days before PDR comment resolution meeting.

PDR Review Team

16. If possible, prior to the comment resolution meeting, review responses for concurrence, discuss with Project Engineer as necessary, and note exceptions for final resolution at the comment resolution meeting.

PDR Team Lead

17. Chair the PDR comment resolution meeting.

NOTE: All comment responses that are not accepted during the meeting shall be Action Plan items.

PDR Team
Members/Design
Authority/Design
Agent

18. Discuss unresolved responses to comments and participate in Action Plan preparation.

PDR Team
Members

19. Develop the PDR Conclusion for documentation in the PDR Memorandum that addresses, as applicable:

- Acceptance with resolution of review comments
- Sufficient deficiencies requiring further design verification
- Significant deficiencies requiring another PDR.

NOTE: For General Service designs, comments may be captured in SPF only, provided there is a means within SPF to document resolution of each comment and acceptance by the respective reviewer.

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|--|---|
| PDR Coordinator | 20. Record the resolution of each comment on a consolidated RCR. |
| | 21. Take notes of any action items, including any unresolved comments, during the course of the meeting. |
| | 22. Prepare meeting minutes after the conclusion of the meeting. |
| Design Authority/
Project Engineer | 23. Have design output documents revised by the Design Agent, based on PDR Team accepted comment/responses. |
| Design Agent | 24. Complete items as requested. |
| PDR Coordinator | 25. Prepare and issue a PDR Internal Memorandum report for review by the PDR Team Lead and Project Engineering manager that includes: <ul style="list-style-type: none"> • A cover letter addressed to the Project Engineering manager and cc to the project team and the Design Engineering manager • Executive summary • Summary list of the PDR comments • RCR (or equivalent from SPF). |
| Project Engineer /
Design Authority | 26. Ensure all items in the review comments for the design phase under review are resolved. |
| | 27. Identify additional Design Review needs. |
| PDR Team Lead | 28. Issue the final PDR Internal Memorandum report to the Project Engineering manager, and cc to the project team and Design Engineering manager. |

5.0 DEFINITIONS

Design Agent. The organization performing the design. This could be an external Architect-Engineering (A-E) firm or in-house design staff.

6.0 RECORDS

The following records are generated during the performance of this guidance document:

- Design Review Checklist
- Review Comment Record
- Design Review Package
- PDR Internal Memorandum report.

The records custodian identified in the Company Level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.

7.0 REFERENCES

- 7.0.1 DOE O 420.1C, “Facility Safety.”
- 7.0.2 INPO 05-002, “Human Performance Tools for Engineers: Practices for Anticipating, Preventing, and Catching Engineering Errors,” March 2005.
- 7.0.3 TFC-ENG-DESIGN-C-25, “Technical Document Control.”
- 7.0.4 TFC-ENG-DESIGN-C-42, “Design Requirements Compliance Matrix.”
- 7.0.5 TFC-ENG-DESIGN-C-45, “Control Development Process for Safety-Significant Structures, Systems, and Components.”
- 7.0.6 TFC-ENG-DESIGN-C-52, “Technical Reviews.”
- 7.0.7 TFC-ENG-DESIGN-P-17, “Design Verification.”
- 7.0.8 TFC-PLN-84, “Tank Farm Operations Contract Project Execution Management Plan.”
- 7.0.9 TFC-PLN-136, “Engineering Design Program.”

Project Design Review Guidance	Manual	Engineering
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ATTACHMENT A – GUIDANCE FOR DESIGN AGENCY “KICK-OFF” AND FOLLOW-ON MEETINGS

Kick-Off Meeting:

WRPS convenes an initial “kick-off” meeting with the design agent, WRPS representatives, and others, as appropriate, to discuss the design criteria package. Prior to the meeting, WRPS representatives (and ORP, as necessary) decide on an agenda and common method. Guidelines for the initial meeting are:

1. The meeting is used to review WRPS contract with the design agent, contract administration, and project requirements.
2. The WRPS project engineer and WRPS project team members present the technical scope of the project, the project design criteria, special safety criteria from the Safety Design Strategy, Preliminary Documented Safety Analysis (PDSA), if applicable, and estimating requirements.
3. In addition to discussing project design criteria, the meeting is specifically used to:
 - a. Review the work scope with particular attention directed to the project schedule and budget.
 - b. Provide guidance on document submittal and approval, as well as on the drawing and specification schedule.
 - c. Establish scope and type of documents required for review at each phase of the design.
 - d. Discuss all pertinent risk assessments and plans.
 - e. Identify tasks assigned to each participant and distribute and discuss the following reference and instructional material, as applicable:
 - 1) Application of Quality Assurance Guidelines for Architect-Engineers
 - 2) Procedure: Preparation of Drawings and Specifications.
 - 3) Project (specific) Modification Traveler, Design Specification or Level 2 spec as applicable.
 - 4) Project (specific) Quality Assurance Plan (if applicable to A-E work) and NQA-1 Requirements. Goal is to ensure the A-E is approved for the appropriate sections of ASME NQA-1.
 - 5) WRPS Engineering Standards and Technical Specifications.

ATTACHMENT A – GUIDANCE FOR DESIGN AGENCY “KICK-OFF” AND FOLLOW-ON MEETINGS (cont.)

- 6) Project Organization Chart and Personnel Index.
- f. Schedule a site visit to the facilities and area of work to the extent practicable.
- g. Explain the necessity for progress review meetings and establish the date for the initial review meeting.

Follow-on Meeting(s):

The WRPS project team representatives should meet with the Design Agency early in the project (within three to six weeks after the “kick-off” meeting, depending on scope) to ensure that the Design Agent is proceeding as instructed and to review the design agent’s progress and general approach to the project. Regular review meetings should follow this initial meeting (frequency dependent on project and risk). Specifically, the meetings are used to:

- 1. Review and recommend any necessary changes to the work scope.
- 2. Refine the schedule for review of the design agent’s drawings and specifications.
- 3. Discuss and resolve any problems with the design criteria, cost estimates, the cost code-work breakdown structure interface, budget and/or approval guides, quality assurance actions, safety system definitions, and any differences in estimated manpower requirements.

ATTACHMENT B – DESIGN DELIVERABLES

Item/Deliverable	Discipline*	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
Architectural Data Sheets	A			Prepare architectural data sheets and include within contract	Finalize	
Architectural Details	A				Initiate and finalize	
Architectural Plans and Elevations and Calculations	A		Single line concept drawings with adequate detail to develop Scope of Work and conceptual design report. Rough mass and material selection calculations for the same purpose	Develop drawings and calculations with adequate detail so that architectural procurement and installation specifications can be developed.	Finalize	
Architectural Schedules & Index Sheet	A			Develop drawings with sufficient detail for completion of architectural procurement and installation specifications as well as contract	Finalize	
Architectural Sections and Calculations	A			Develop sections and calculations with sufficient detail for completion of architectural procurement and installation specifications.	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
Architectural Specifications	A			Prepare specifications for the procurement and installation of architectural building components.	Finalize	
Penetration Seals	A				Initiate and finalize	
Radiological Zone Drawings	A			Initiate	Finalize	
Rendering & Models	A		Renderings and models to help visualize architectural concepts and layouts.	More refined renderings and models with emphasis on selection of finishes, doors, windows, hardware, etc.	Renderings and models showing details of furnishings, interior layout.	
Architectural Finish Schedule	A				Initiate and finalize	
Civil Site Preparation Calculations	C/S			Develop to sufficient detail so that civil site procurement and installation specifications can be completed.	Finalize	
Civil Specifications	C/S			Prepare documents for the procurement and installation of all civil site facilities (sanitary/storm sewers, excavation/backfill, sheet piling & dewatering, grading, etc.)	Finalize	
Cut and Fill Calculations	C/S		Initial calculations in support of project baseline estimate and conceptual design report.	Refine calculations in support of major site contract packages (excavation/backfill, grading)	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
Ductbanks	C/S				Initiate and finalize	
Engineered Civil Data Sheets	C/S			Prepare documents for the procurement and installation of all facilities (tanks).	Finalize	
Foundation Drawings and Calculations	C/S			Develop foundation drawings and calculations with adequate detail so that structural procurement and installation specifications can be completed.	Finalize	
Geometry Calculations	C/S		Initial calculations in support of project baseline estimate and conceptual design report.	Refine calculations in support of major site contract packages (excavation/backfill, grading, road and railroad alignment)	Finalize	
Geotechnical Reports	Geotech	Initiate investigation	Report of geotechnical field explorations in support of site selection and feasibility studies.	Report of geotechnical field explorations in support of general foundation, building and seismic designs.	Finalize	
Grading	C/S				Initiate and finalize	
HVAC Supports Drawings and Calculations	C/S				Initiate and finalize	
Instrumentation Supports Drawings and Calculations	C/S				Initiate and finalize	
Manholes	C/S				Initiate and finalize	
Maps and Soil Borings	Geotech	Initiate maps and borings	Depiction of geotechnical field explorations in	Depiction of geotechnical field		

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
			support of site selection and feasibility studies.	exploration for design of buildings and structures.		
Misc. Steel Calculations, Grating, Handrails, Plate Drawings and Calculations	C/S				Initiate and finalize	
Miscellaneous Steel, Plans, Sections & Details	C/S				Initiate and finalize	
Pipe Supports/Pipe Racks Drawings and Calculations	C/S				Initiate and finalize	
Roads/Railroads Drawings and Calculations	C/S			Preliminary	Initiate and finalize	
Sanitary/Storm Sewers Drawings and Calculations	C/S				Initiate and finalize	
Seismic Analysis	C/S			Prepare preliminary calculations	Finalize calculations	
Settling Basins	C/S				Initiate and finalize	
Sheet Piling & Dewatering	C/S				Initiate and finalize	
Shoring Drawings and Calculations	C/S				Initiate and finalize	
Site and Plot Plans	C/S		Overall layout of buildings, roads, access roads, railroad and utility connections for project validation at CDR.	Refine to let civil site contracts and issue long lead permit applications.	Finalize	
Soils and Earth Pressure Calculations	C/S /Geotech				Initiate and finalize	
Structural Concrete Plans and Calculations	C/S		Conceptual documents with adequate detail to develop project baseline estimate and conceptual design report.	Refine documents to support specifications and contract for structural concrete.	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
Structural Concrete Sections & Details and Calculations	C/S			Develop documents with sufficient detail for completion of structural concrete procurement and installation specifications.	Finalize	
Structural Data Sheets	C/S			Prepare structural data sheets for applicable facilities and include within contract packages.	Finalize	
Structural Specifications	C/S			Prepare specifications for the procurement and installation of buildings, structures, and components.	Finalize	
Structural Steel Drawings and Calculations	C/S		Conceptual documents with adequate detail to develop project baseline estimate and conceptual design support.	Refine documents to support specifications and contract for structural steel.	Finalize	
Tray and Conduit Supports Drawings and Calculations	C/S				Initiate and finalize	
Wells	C/S				Initiate and finalize	
Yard Utilities Drawings and Calculations	C/S				Initiate and finalize	
Master Plan	C/S/A		Combine site selection studies, facility relationship diagrams, site arrangement concept studies, site access and egress studies into one comprehensive master plan.	Update as needed	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
Configuration Management Plan (CMP)	SE		Initiate and complete	Update as needed	Update as needed	
Area Classification Drawings	E			Show hazardous areas and class if hazard analysis warrants special mitigative requirements. Not required for all projects	Finalize	
Cable Schedule (PDMS)	E				Initiate and finalize	
Cathodic Protection Drawings	E			Develop location plans of cathodic protection anodes, test stations (to support installation of yard piping systems)	Finalize	
Communication Drawings	E				Initiate and finalize	
Conduit Schedule (PDMS)	E				Initiate and finalize	
Coordination Study Drawings	E				Initiate and finalize	
Electrical Equipment Sizing Drawings	E		Initiate, major components of the distribution system	Refine	Finalize	
Grounding Drawings	E			Develop grounding conductor layout (to support installation of foundations etc.)	Finalize	
Grounding Grid Calculations	E			Develop to estimate the number of ground rods/grid size	Finalize	
Heat Tracing Drawings	E				Initiate and finalize	
Interconnection/ Wiring Diagrams	E				Initiate and finalize	
Lighting Calculations/Drawings	E			Develop to estimate quantity of lighting fixtures with layout	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
				based on preliminary plant arrangement		
Lighting Protection Drawings	E				Initiate and finalize	
Load study/Short circuit calculations	E		Preliminary based on preliminary single line equipment ratings	Update to include majority of the process loads	Finalize	
Overhead Pole Line Drawings	E		General Plan with pole locations	Refine General plan	Finalize	
Panel Schedules	E				Initiate and finalize	
Power Services Utilization Permits	E		Initial request		Final request	Approved
Raceway Layout drawings	E			Develop layout of cable trays and main feeder conduit runs	Complete to show all the remaining Equipment conduits	
Schematic Diagrams	E			Develop control schematics for substation equipment (to support procurement specs.)	Complete control schematics for mechanical/ process systems	
Single line Diagrams	E		Preliminary based on conceptual process design and loads.	Revise to reflect well defined process loads and issue to support procurement specifications	Finalize	
Three line meter & relay diagrams	E			Develop meter and relay schemes for substation equipment (to support procurement specs.)	Finalize	
Underground Utilities Duct banks/Manholes	E			Develop duct bank route, profile and location of manholes (to support installation of yard piping systems)	Finalize	
Fire Protection System Drawings	E/J			Initiate	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
Overhead Line Sag Calculations	E/S				Initiate and finalize	
Engineered Equipment Specifications/Data Sheets	E/SE		Issue data sheets or mini specs for major equipment to develop cost estimate	Prepare and issue procurement specs for major equipment	Procurement specs for remaining equipment	
Environmental Permits	Env		Prepare Permitting Plan to show which permits are needed, plan for preparation (i.e., start date, completion date, man-hours needed), estimated times for approvals, and guidance preparation	Complete permit packages containing all required state forms filled out, an engineering report that describes the project, simplified drawings (process flow, P&IDs, detailed where required) and stamped by a registered (State of WA) professional engineer.	Submit all permit packages. Approval required before construction can begin.	
ALARA Considerations	General		Identify and locate major sources of radioactivity	Optimize layout for operational and Exposure considerations and ALARA review	Finalize, cost benefit analysis if required	
As-built Documents	General					Prepare and issue per the Configuration Management Plan
Bid Evaluations/Award	General				Initiate	Complete
Databases -Assumptions & Technical	General		Initiate	Update	Update	Close
Demolition and Removal (D&R) Drawings	General				Initiate and finalize	
Design Criteria (MT, F&Rs and/or Design Specifications)	General	Initial design criteria finalized	Update to support the conceptual design report	Update as needed		
Engineering Change Notice (ECN)	General			Initiate	Issue as appropriate for new design or to	Prepare/approve as required

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
					revise issued drawings	
General Notes, Symbols & Standard Details	General			Develop drawings with sufficient detail for completion of procurement and installation specifications as well as contract packages.	Finalize	
Construction Specification	General				Initiate and finalize	
Nonconformance Reports (NCR)	General					Disposition as required
Permitting Requirements	General		Identify preliminary requirements	Issue Permitting Plan		
High-Performance Sustainable Building (DOE G 413.3-6B)	General		Sustainable Design Report	Updated Sustainable Design Report	Updated Sustainable Design Report	Finalized Sustainable Design Report
Project Baseline Estimate	General		Preliminary	Definitive	Update as required	
Modification Quality Inspection Plan	General				Initiate and finalize	
Redlines	General					Approve as required
Site Selection Studies	General	Site selection criteria	Preliminary characterization and site selection	Final characterization and site selection		
Statements/Scope of Work	General	Initiate Engineering Work Plan for in-house design	Develop for Task Order or in-house project work on Preliminary Design	Develop for Task Order or in-house project work on Detailed Design	Develop for Task Order or in-house construction	
Request for Information (RFI)	General	For vendor design services only: Process as required	For vendor design services only: Process as required	For vendor design services only: Process as required	For vendor design services only: Process as required	Process as required from construction, fabrication, and vendor's construction design services
Supplier Documents	General				Review and Status	Review and Status
Technology Development	General	Issue Technology Development Plan		Technology Development complete		

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
Testing support	General	Small scale testing	Proof of concept testing	Testing requirements identification. May be included in the test requirements matrix.		Support to Construction and Start-up
Acceptance Tests Requirements/ Functional Test Requirements	General/ SE	Project level requirements		Preliminary issue	Final Issue	
Alternative Studies	General/SE	Studies and assessments	Complete studies and assessments			
Conceptual Design Report (CDR)	General/SE		Initiate and complete.			
Design Alternatives	General/SE		Complete to support project schedule and cost baselines.	Continuing effort via Value Engineering to optimize design	Continuing effort via Value Engineering	
Engineered Equipment Specifications	General/SE		Provide detailed description of equipment including operation parameters to provide preliminary pricing basis.	Develop details for specifications that are used as a detailed pricing basis for project funding.	Finalize	
Team/Engineering Execution Plan	General/SE		Initiate and complete	Update as needed	Update as needed	
Functional Acceptance Criteria (FAC)	General/SE		Identify Functional Acceptance Criteria	Draft Functional Acceptance Criteria Document	Issue	
Interface Control Document	General/SE		Initiate and complete	Updated as needed to reflect design evolution.	Update as needed	
Primary/Alternate Site Selection	General/SE	Initiate	Complete to support conceptual design.			
Reliability, Availability, Maintainability and Inspectability (RAMI) Analysis	General		Determines requirements at the facility, system, and major component level.	Refine as the design evolves to determine component level requirements.	Finalize	
Risk Analysis	General/SE		Based on risk screening analysis, includes technical risk analysis	Update as required to reflect design evolution	Update as required	
Risk Management Plan	General	Initial risk assessments	Initiate and complete	Updated as needed to reflect design evolution.	Update as needed	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
System Design Description (SDD)	General		Complete Section 1 - Functions and Design Requirements	Complete Section 2 – System/component design description	Complete Remaining sections	Update as necessary
F&Rs and Specifications	General	Initial design criteria	Prepare to support SDD	Update to reflect design evolution		
Design Requirements Compliance Matrix	General			Initiate	Complete	
Control narrative	J	Industrial Control System and Operational Technology strategy. Information utilization strategy.	Initial Control Narrative	Control Narrative Complete		
Control Panel Layout	J			To size the panel, layout all major components. Rear of the panel arrangement may not be included.	Finalize	
Control Room Layout	J		Only major components shown to estimate size requirement of room	Layout all consoles and panels to finalize the size of the room	Finalize	
Control Valve Calculations	J			Use preliminary process calculation information with caution to determine approximate size of the flow meter.	Finalize	
Flow Meter Sizing Calculations	J			Use preliminary process calculation information with caution to determine approximate size of the flow meter.	Finalize	
Input/output Summary	J			Show instrument tag number, I/O type and system designation.	Finalize	
Instrument Data Sheet	J			Show tag number, service description, P&ID number, available process data and other	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
				salient features of instrument.		
Instrument Index	J		Initiate	Include instrument tag numbers, P&IDs, instrument type, location, and service description.	Finalize	
Instrument Installation Detail	J				Initiate and finalize	
Instrument Location Drawing	J			Show instruments, major instrument racks, and field panels. Piping drawings to locate inline devices may not be available to show other instruments.	Finalize	
Instrument Rack Drawing	J				Initiate and finalize	
Level Setting Diagram	J				Initiate and finalize	
Logic Diagram	J		Overall logic description for Safety Class systems	Include information to present basic system operation in conjunction with P&ID	Finalize	
Loop Diagram	J				Initiate and finalize	
Set Point Index	J				Initiate and finalize	
Specification for Controls and Instrumentation	J			Include scope, exceptions, codes and standards, preliminary design requirements.	Finalize	
System Process Graphics Layout	J				Initiate and finalize	
System Block Diagram	J/E		Major components shown indicate system	All components of the system shown with tie-ins.	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
			interrelationships and connectivity			
Dimensional Record Drawings	M				Initiate and finalize	Update for dimensional record
Engineered Equipment Data Sheet	M			Provide detailed description of equipment including operation parameters to provide preliminary pricing basis. This may be used in lieu of or to supplement engineering specification.	Finalize	
Equipment Requirement drawing	M			Used only for mechanical equipment that is built as shown on detailed fabrication drawings (not vendor drawings). Supports detailed pricing for project funding.	Finalize	
Equipment Sizing calculations	M		Calculations sufficient to support sizing of major components.	Further develop calculations to support preliminary equipment specifications.	Finalize	
Fire Alarm System Selection and Design	J/E		Identify hazard basis.	Develop design and equipment requirements.	Finalize.	Acceptance Test Plan and Fire Permit.
Fire Suppression System Selection and design	M		Identify hazard basis (NFPA 13); select type of fire suppression and protection, and area to be protected.	Define supply piping, major valves, general layout, and detection system.	Finalize	Acceptance Test Plan and Fire Permit
Fire Hazards Analysis	F		Initiate revision to existing FHA	Complete draft revisions FHA	Issue Fire Hazard Analysis	
Flow Diagrams	M	Proposed process material flow	Establishes preliminary flow quantities with appropriate operating	Finalizes the flow quantities and defines	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
			parameters (i.e. operating pressure and temperature). Defines major components for sizing basis and associated mass and energy balance. Defines system boundaries. (May not be required on existing modification projects).	the major component sizing.		
Hydraulic Calculations	M		Calculations sufficient to support mechanical component sizing in P&IDs.	Further develop calculations to support preliminary P&IDs.	Finalize	
Line list	M			Initiate	Finalize	
Piping and Instrument Diagrams	M		P&IDs are flow schematics typically provided for process, HVAC, and sample systems. Schematic includes all primary components such as piping, ducts, pumps, compressors, fans, vessels, heat exchangers, main control valves, and major system controls. Identify system boundaries.	Details are included to ensure proper system operation. Mechanical components are defined adequately to development preliminary equipment specification. Also isolation valves, pressure protection, and process controls are defined to develop component specifications. Electrical loads are identified for development of single lines. Issue Revision 0.	Finalize	
Piping Specifications	M			Provide details for the piping system requirements that include governing Code, sizes, schedules, materials, and other components.	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
Piping Stress Calculations	M				Initiate and finalize	
Pressure Relief Device Verification Records	M				Initiate, preliminary status	Finalize
Pressure vessel verification records	M				Initiate, preliminary status	Finalize
System Calculations	M		Calculations sufficient to support P&IDs and sizing of major components.	Further develop calculation to support preliminary P&IDs and equipment specifications.	Finalize	
Valve list	M		Initiate	Update	Finalize	
Equipment List	M/E		Develop database for all mechanical and electrical equipment. Only major components are identified with associated equipment identifiers.	Further develop database for all mechanical equipment. Other system components are identified with associated identifiers.	Finalize	
3D model	P		Overall conceptual design with major equipment shown to define space requirements and quantities for estimating, as applicable.	Refine to include design information as design evolves. Produce quantity reports and drawings.	Refine to identify Potential interferences - finalize	As-built if required
Area Piping Drawings	P				Initiate and finalize	
General Arrangements	P		Overall building plan includes room layout, major equipment and pipe chases, facilities and corridors.	Refined based on customer preferences and other discipline input.	Finalize	
HVAC Layout Drawings	P			Initiate	Finalize	
Jumper Design Drawings	P				Initiate and finalize	
Layout Drawings	P		Plant layout	Layout drawings for major components	Finalize	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
Machine Design Drawings	P			Start to support long lead procurement items or part of a purchase specification.	Others initiate and finalize	
Piping Isometrics	P			Start to support piping stress analyses.	Others initiate and finalize	
Equipment Locations	P/E		Initiate		Finalize	
Safeguards and Security Requirements	Safeguards & Security	Draft Safeguards Requirement Identification (SRI)		Finalize plan	Implement plan	Safeguards and Security Management Report
Vulnerability Assessment Stud	Safeguards & Security	Preliminary study	Conceptual study		Draft report issued	Final Report
Emergency Preparedness Hazards Assessment (EPHA)	Safeguards & Security	Prepare EPHA	Update as necessary	Update as necessary	Update as necessary	Update as necessary
System Engineering Management Plan (SEMP)	SE	Prepare and issue	Update as needed	Update as needed	Update as needed	
Value Engineering	SE	Perform Value Engineering Studies	Perform Value Engineering Studies	Perform Value Engineering Studies		
Process Flow Sheets	PE	Develop	Update as needed	Update as needed	Update as needed	
Criticality analysis	NS&L		Support to Preliminary Hazard Analysis	Support to Safety Analysis	As needed to evaluate design evolution	
Hazard Categorization Report	NS&L	Initiate revision		Complete draft revision to Hazard Categorization Report		Issue revised Hazard Categorization Report
Functional Classification Report	NS&L		Prepared based on PrHA results. Issue preliminary classifications	Updated as needed to reflect design evolution.	Finalize - update as needed to reflect design evolution.	
Hazard Analysis	NS&L		Preliminary analyses for initial functional classifications	Accident analyses for Documented Safety Analysis and final functional classifications	Update as needed to reflect design evolution.	
Hazardous Area Classification Report	PE		Update as needed	Initiate Document	Finalize and issue Hazardous Area	

ATTACHMENT B – DESIGN DELIVERABLES (cont.)

Item/Deliverable	Discipline	Pre-Conceptual Design	Conceptual Design	Preliminary Design	Final Design	Implementation Support and Closeout
					Classification Report	
Safety Design Strategy	NS&L	Prepare to define nuclear safety strategy for the project	Update as needed	Update as needed		
Documented Safety Analysis	NS&L		Preliminary Functional Classification and Hazard Analysis established to support key technical parameters and design requirements	Draft DSA, revisions	Finalize DSA revisions; initiate USQD	Issue DSA, revisions and USQD
Technical Safety Requirements (TSR)	NS&L				Initiate	Finalize
Shielding	RADCON/ M/CS		Preliminary analysis Facility layout and Radiological material location. Define dose limits, estimate wall thickness requirements	Refine previous analyses, determine shielding requirements	Finalize calculations	

* Discipline Key:

Identifier	Description
A	Architectural
E	Electrical
F	Fire Protection
M	Mechanical
P	Plant Design (CAD)
NS&L	Nuclear Safety and Licensing
RADCON	Radiological Control Engineering
SE	System Engineering
C/S	Civil/Structural Engineering
J	Instrument & Controls
PE	Process Engineering

ATTACHMENT C – SUGGESTED REVIEW QUESTIONS

The following lists of questions are provided for the project engineer to select for use by review teams as applicable. The questions are not intended to indicate the existence of a requirement applicable to the project.

Pre-Conceptual Phase

(Note: Design products for Pre-Conceptual phase are not addressed in Attachment B. Design output products are negotiated with the Integrated Project Team)

PC-1: Has the mission been established, accepted and approved as defined?

PC-2: Are the criteria presented those necessary to ensure the project will meet the functional requirements?

PC-3: Does the criteria provided identify the necessary codes, standards and DOE orders to ensure the project design will comply with the required regulatory and performance requirements?

PC-4: Have all alternatives been identified and has sufficient justification been provided to support the alternative selected?

- Schedule and Path Forward (Coordinator)
- Arrange times/locations for subsequent meetings (e.g., review meetings, comment resolution meetings, report out meetings, closure meeting)

PC-5: If design parameters are provided, is sufficient backup provided to justify limiting the design agency at this stage of the project? It is not the purpose of the design input documentation to design the project, but rather to evaluate project alternatives and identify required criteria. However, it is sometimes necessary to identify some design detail. When this is done, adequate justification must be provided since this limits the possible design options.

PC-6: Design recommendations, when included in the design input, should also be justified to provide the Design Agency the rationale for consideration.

PC-7: Have design optimization strategies/viable options been considered such as:

- Ensuring appropriate tailoring of engineering, standards, guides, and risk mitigation strategies,
- Selecting the most economical materials,
- Using integrated design methodologies, design optimization software, simulation techniques, product family design, performance models
- Capitalizing on technology transfer/research collaborations and previous/concurrent related designs from other projects/DOE sites.

PC-8: Have design and hazard classifications been identified with rationale for selection?

PC-9: Have functional classifications been established with rationale?

ATTACHMENT C – SUGGESTED REVIEW QUESTIONS (cont.)

PC-10: Have the correct technical issues and assumptions been identified? Have risks, responsibilities, and schedule for resolution been documented?

PC-11: Has design verification or checking been completed when required?

PC-12: Have technical risk management concerns been addressed such as state of the art advances, unique or harsh operating environments, integration/interface complexity, maintainability (i.e., in radiation environment), unique physical, material, or radiation properties, and unusual application or combination of standard components?

PC-13: Have risk mitigation strategies been developed and scheduled?

PC-14: Have project level-acceptance test requirements been established?

PC-15: Has a preliminary vulnerability assessment study been completed?

PC-16: Have technology development activities been identified?

PC-17: Are the interfaces between this facility modification and other associated facility modifications defined and roles and responsibilities for the interface defined?

ATTACHMENT C – SUGGESTED REVIEW QUESTIONS (cont.)

Conceptual Phase

(Note: Design products for Conceptual phase are not addressed in Attachment B. Design output products are negotiated with the Integrated Project Team)

C-1: Does the technical portion of the CDR/CDP (less cost and schedule requirements) agree with and fully implement the requirements in the pre-conceptual design input, and Preliminary Hazards Analysis (PrHA) (when required)? Special attention should be given to ensure assumptions identified in the pre-conceptual design have been addressed during the conceptual design.

C-2: Have all Action Plan Items from the pre-conceptual PDR scheduled for conceptual design been completed?

C-3: Have alternative studies been completed?

C-4: Have design optimization strategies/viable options been considered such as:

- ensuring appropriate tailoring of engineering procedures, standards, guides, and risk mitigation strategies,
- selecting the most economical materials,
- using integrated design methodologies, design optimization software, simulation techniques, product family design, performance models
- capitalizing on technology transfer/research collaborations and previous/concurrent related designs from other projects/DOE sites.

C-5: Has justification been provided to support the selected alternative?

C-6: Have safety system requirements for the functional classification been included in the design (i.e.: single failure, redundancy, emergency power, equipment qualification requirements, seismic requirements, etc.)?

C-7: Does the design satisfy all established performance requirements?

C-8: Have the correct technical issues/assumptions been identified along with required actions to resolve them and their potential impact on the cost estimate?

C-9: Have all required interfaces been identified, such as utilities (power, water, sewage, etc.), roads, safeguards, security, etc.?

C-10: Does design work include evaluation and selection of energy conservation methods? Pollution Prevention?

C-11: Does design work include evaluation and selection for minimizing waste and ALARA?

ATTACHMENT C – SUGGESTED REVIEW QUESTIONS (cont.)

C-12: Has sufficient design information been provided to develop a cost Estimate for the project?

C-13: Have technical risk management concerns been addressed such as state of the art advances, unique or harsh operating environments, integration/interface complexity, maintainability (i.e.: in radiation environment), unique physical material, or radiation properties, and unusual application or combination of standard components?

C-14: Have risk mitigation strategies been developed and scheduled?

C-15: Has the design verification or checking as required been completed?

C-16: Have engineering design development and review strategy requirements been identified and documented?

C-17: Have preliminary safety classifications been identified for preliminary structures and systems?

C-18: Have preliminary permitting requirements been identified?

C-19: Has a Design Requirements Compliance Matrix and/or a Design Specification Level 2 document been initiated?

C-20: Are the interfaces between this MT and other associated MTs defined and roles and responsibilities for the interface defined?

C-21: Has a list of design standards to be used in the design been submitted to DOE-ORP for approval as applicable?

ATTACHMENT C – SUGGESTED REVIEW QUESTIONS (cont.)

Preliminary Design Phase

PD-1: Does the preliminary design agree with and implement the current requirements of the design input and Preliminary Hazard Analysis (when required)?

PD-2: Have the correct functional classifications for identified structures, system and components been established?

PD-3: Have required analyses of health, safety, and environmental protection been performed (e.g., Environmental, Industrial Hygiene, Rad Tech)?

PD-4: Have special methods of construction that may impact cost/schedule been developed/identified/justified?

PD-5: Have design optimization strategies/viable options been planned such as:

- appropriate selection of engineering, standards, guides, and risk mitigation strategies,
- use of the most economical materials,
- use of integrated design methodologies, design optimization software, simulation techniques, product family design, performance models
- technology transfer/research collaborations and previous/concurrent related designs from other projects/DOE sites.

PD-6: Does design work include evaluation and selection for energy conservation? Pollution Prevention?

PD-7: Does design work include evaluation and selection for minimizing waste and ALARA?

PD-8: Have all Action Plan Items from previous PDR's that were scheduled during Preliminary Design completed?

PD-9: Does the design include required features for special facilities in accordance with the functional classification?

PD-10: Have the correct technical issues/assumptions been identified along with required actions to resolve them and their potential impact on the project?

PD-11: Are system boundaries identified?

PD-12: Are component requirements identified but not selected?

PD-13: Have testing requirements been identified?

ATTACHMENT C – SUGGESTED REVIEW QUESTIONS (cont.)

PD-14: Is Engineering design development complete with contingency for open issues (engineering deliverables, Engineering Work Plan, technical studies/reports, subcontracting, staffing/resources)?

PD-15: Has Engineering review strategy been developed with contingency for open issues (types and level of reviews with justification, project reviews, Design Authority reviews, Technical Agency reviews, additional PDRs, review and comment methodologies)?

PD-16: Has a Value Engineering Study been completed?

PD-17: Has the Risk Management Plan been updated?

PD-18: Has a Functional Design Criteria document completed?

PD-19: Are P&ID Rev. 0 completed?

PD-20: Are Accident Analyses completed?

PD-21: Are Reliability, Availability, Maintainability, and Inspectability (RAMI) needs allocated?

PD-22: Are preliminary layout drawings of major components completed?

PD-23: Has the Design Requirements Compliance Matrix been completed?

PD-24: Have technical risk management concerns been addressed such as state of the art advances, unique or harsh operating environments, integration/interface complexity, maintainability (i.e.: in radiation environment), unique physical, material, or radiation properties, and unusual application or combination of standard components, limited vendor capabilities, accuracy of existing drawings, level of subcontracting?

PD-25: Have mitigation strategies been implemented and/or risk reduction tools been considered/executed (application of lessons learned, six sigma PIPs, design development tools such as software, guidance documents, handbooks, cookbooks, etc.)?

PD-26: Have the PrHA, Unreviewed Safety Question Determination (USQD) and Documented Safety Analysis (DSA) adequately addressed the credible hazards and accidents of the project?

PD-27: Have the design verification or checking as required been completed?

PD-28: Are the interfaces between this facility modification and other associated facility modifications defined and roles and responsibilities for the interface defined?

PD-29: Does a Failure Modes and Effects Analysis (FMEA) need to be performed (TFC-ENG-DESIGN-C-45)?

ATTACHMENT C – SUGGESTED REVIEW QUESTIONS (cont.)

Final Design Phase

FD-1: Has the Design Requirements Compliance Matrix been completed?

FD-2: Does the definitive/final design completely implement the current requirements of the PrHA?

FD-3: Does the design adequately address requirements of the functional classification and the DSA for existing facilities? USQD or preliminary DSA for new facilities?

FD-4: Have all Action Plan items from previous PDRs as they apply to final design been completed?

FD-5: Have planned design optimization strategies/viable options been implemented such as:

- Appropriate tailoring of engineering procedures, standards, guides, and risk mitigation strategies,
- Use of the most economical materials,
- Use of integrated design methodologies, design optimization software, simulation techniques, product family design, performance models
- Technology transfer/research collaborations and previous/concurrent related designs from other projects/DOE sites.

FD-6: Is the detail design compatible with interfacing equipment, systems, facilities, computers, and personnel?

FD-7: Are all detailed design drawings, calculations, specifications etc., except field run items completed?

FD-8: Is sufficient design detail provided to clarify construction, installation and inspection methods and requirements?

FD-9: Does the equipment arrangement and spacing requirements provide adequate accessibility for Maintenance?

FD-10: Has the design included provisions to perform tests required to verify performance requirements and calculated values?

FD-11: Have all the technical issues/assumptions been resolved?

ATTACHMENT C – SUGGESTED REVIEW QUESTIONS (cont.)

FD-12: Have all technical risk analysis issues been resolved such as state of the art advances, unique or harsh operating environments, integration/interface complexity, maintainability (i.e.: in radiation environment), unique physical, material, or radiation properties, and unusual application or combination of standard components?

FD-13: Has the design verification or checking as required been completed?

FD-14: Are the interfaces between this facility modification and other associated facility modifications defined and roles and responsibilities for the interface defined?