CPCCo
Central Plateau
Cleanup Company

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Administrative Procedure, Level 1 - Company Wide

CPCC-PRO-EN-40271

Engineering Design Process

Revision 0, Change 4

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Functional Manager: Kujath, Brett A

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324 Building	GCX-7 (Minor Change)	Hicks, Jarrod J
Below HazCat 3	**Exclusion Reason:** *N/A per PRC-PRO-NS-062, Section 1.3; LHC3F*	
Canister Storage Building/Interim Storage Area	(Screening/Determination Performed (no issues)) *CSB-25-112*	Dubois, Valerie M
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Change Summary

Description of Change

Section 3.2 added Design Interface requirement
Section 3.2.2 added Essential design methods requirement and design information communicated orally requirement
Section 3.2.4 added requirements for design changes
Section 3.3 added design interface requirement
Section 3.3.3 added engineering analysis requirement
Section 3.3.5 added step 5
Section 6.1 added QAP

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1.0 INTRODUCTION

1.1 PURPOSE

This procedure describes the engineering design process used in the preparation and implementation of Central Plateau Cleanup Company (CPCCo) designs for construction and fabrication of systems, structures, and components (SSC) at the Hanford Site.

This procedure describes the design process from initiation through final turnover to Operations. The traditional engineering design phases and steps performed for a typical design are generally described. This procedure points to other engineering procedures and standards when more detailed information is needed.

This procedure implements the requirements for engineering design process contained in CPCC-RD-EN-1819, *Engineering Requirements* and is an ISMS implementing document.

1.2 SCOPE

This Level 2 procedure applies to engineering designs prepared for CPCCo tasks and activities. This procedure describes the general engineering design process used for engineering, procurement, and construction type activities from design initiation through construction and final turnover to Operations. These activities can range from a simple facility modification to a major capital construction project.

1.3 APPLICABILITY

This procedure applies to any engineering design activity performed for CPCCo. The process described in this procedure applies to the full range of engineering design activities including facility modifications, in-house designs performed by CPCCo personnel, or designs performed by offsite architectural-engineering (AE) firms.

Engineering design activities supporting CPCCo construction projects managed in accordance with CPCC-MP-PM-53011, *CPCCo Project Management Plan*, shall be performed in accordance with this procedure.

Although facility modifications made to CPCCo identified configuration managed structures, systems, and components (CM SSC) follow the engineering design process described in this procedure, they are performed in accordance with CPCC-PRO-EN-2001, *Facility Modification Package Process*.

Throughout this procedure, references are made to CPCCo engineering procedures for additional direction and information. Designs that are outsourced to third-party engineering firms may be directed to use the CPCCo engineering procedures or may use their own if available. If directed to use their own, the third-party procedures shall be evaluated against the equivalent CPCCo procedure to verify suitability for the intended task.

1.4 IMPLEMENTATION

This procedure is effective upon publication.

2.0 RESPONSIBILITIES

All responsibilities associated with this procedure are identified in the process steps.

3.0 PROCESS

3.1 DESIGN AUTHORITY AND DESIGN AGENT

For the engineering design process, the positions involved are identified as:

Design Authority: The individual or organization responsible and accountable for specifying the requirements of the design and for final acceptance of the design. Represents CPCCo during design development and implementation. NOTE: This individual may or may not be the same individual assigned as Design Authority for the operating SSCs upon turnover.

Design Agent: The individual, team, or organization responsible and accountable for performance of design activities and preparation of a technically adequate design which implements the requirements specified by the Design Authority.

The functions of the Design Authority and Design Agent are as follows:

Position	Functions and Responsibilities
Design Authority	Develop functional requirements, design criteria, and design constraints for the design
	Coordinate interfaces within the client organization
	Prepare design requirements documentation
	Identify Design Agent
	Evaluate third-party Design Agent procedures against CPCCo equivalents for adequacy
	Provide direction to the Design Agent
	Review design products (30/60/90 design phases) and provide responses/direction to the Design Agent
	Review Final Design to ensure design accurately implements and satisfies the requirements of design
	Accept/Approve Final Design for implementation

Position	Functions and Responsibilities
	Coordinate with Design Agent to provide engineering during construction/fabrication
	Oversee acceptance testing and coordinate with Design Agent
	Establish as-building requirements and ensure field verification and as-building is performed and completed
	Coordinate acceptance with Operations
	Ensure the technical baseline is updated to reflect current field conditions
Design Agent	Review and understand design requirements for the design
	Identify disciplines and resources needed to complete design
	Develop and analyze alternatives for the design
	Interpret code requirements
	Develop design concept(s)
	Prepare design calculations and analyses
	Prepare design output documentation (drawings, specifications, etc.)
	Ensure design adequately implements the design requirements
	Prepare acceptance testing and Inspection documentation
	Prepare designs and design reports for 3/60/90 design phases as required
	Disposition comments from the Design Authority or Client
	Support/provide engineering during construction/fabrication
	Support/perform acceptance testing
	As directed by the Design Authority, perform field verification and as-building
	Provide completed (100%) design documentation to the Design Authority

For small or minor facility modifications, the Design Authority may also perform the Design Agent function. For projects and major modifications, these functions will typically be performed by separate individuals or organizations.

3.2 PHASES OF THE ENGINEERING DESIGN PROCESS

An engineering design process is typically performed in the following phases:

1. Design Initiation Phase
2. Conceptual Design Phase
3. Definitive Design Phase (i.e., Preliminary Design, Final Design)

4. Engineering During Construction

5. Turnover and Closeout

These phases describe the typical life cycle of an engineering design from inception to closeout. Each phase includes certain activities and deliverables.

Design interfaces (both equipment interfaces and organizational responsibility) shall be identified and controlled (review, approval, release, distribution and revision) throughout all phases of the engineering design process.

For Capital Asset projects performed in accordance with CRD O 413.3B requirements, the project design shall include, at a minimum, a Conceptual, Preliminary, and Final Design Review, in accordance with the projects Project Execution Plan (PEP). For nuclear projects, the design reviews will include a focus on safety and security systems. For Haz Cat 2 and Haz Cat 3 facility design changes, if all phases are not completed then the Engineering Manager must provide documented justification why a phase was not implemented.

For nuclear facility projects, a Code of Record shall also be prepared and maintained under configuration control throughout the design process and the remainder of the facility's life-cycle.

3.2.1 Design Initiation Phase

The Design Initiation Phase begins with the identification of the need for an engineered design. The requested engineering design services can vary from a simple modification to a formal construction project. This request is typically made to an organization's engineering management by Operations or a Project Manager.

This phase typically includes the following steps of the engineering design process:

1. Initiate Design

2. Identify Design Inputs

This phase may also require that some engineering analysis or studies be performed such as feasibility, technology readiness, site suitability, etc.

Once the need for an engineering design is identified, a Design Authority (DA) is identified. The Design Authority reviews the design scope and identifies the processes involved, functional requirements, applicable codes and standards, design criteria, and design constraints.

The Design Authority documents design requirements in a design requirements document or Engineering Package (EP) as described in CPCC-STD-EN-40255, *Design Requirements Documentation*. For Formal Projects, a functional design criteria (FDC) is typically prepared. A design requirements document (e.g., FDC) provides the functional requirements and design criteria needed to develop the design and perform design verification of the final design. At the end of this phase, the design requirements document is approved, released, and placed under configuration control. Design requirements documentation should also be included in the SSCs configuration baseline.

Products resulting from completion of this phase include:

- Design requirements document, or

FDC for formal construction projects

3.2.2 Conceptual Design Phase

Using the design requirements provided by the Design Authority, the Design Agent performs the conceptual design phase, which typically accounts for the first 30% of the design.

This phase generally includes the following steps of the engineering design process:

1. Perform Design Analysis
2. Develop Preliminary Design Outputs (e.g., process flow diagrams [PFD], piping, and instrumentation diagrams [P&ID])
3. Identify Major Equipment Needs

Conceptual design includes identification and analysis of different options for implementation of the design solution. Potential options are identified and analyzed for technical feasibility and adequacy, programmatic implementation, and cost effectiveness. A preferred option is chosen and the rationale for the choice is documented.

Essential design methods, materials, parts, equipment, and processes shall be chosen and assessed to ensure they are fit for their intended purpose. Information gained from past experiences, documented in reports or other formats, shall be accessible to the design personnel. Once the preferred option is identified, process or conceptual diagrams are prepared. These diagrams (e.g., PFDs and P&IDs) form the basis for more detailed design performed in the next phase. PFDs or P&IDs prepared during this phase are typically issued or released and placed under configuration control.

The conceptual phase can include a number of different engineering analyses and studies. In addition to the analysis of design options leading to selection of the preferred option, other studies/analysis may include:

- Site studies
- Environmental evaluation
- Available technology research
- Technology readiness assessment
- Trade-off or optimization studies
- Hazards analysis
- Nuclear safety analysis
- Climate Analysis
- Fluid Characteristic

If it is determined the design is subject to the requirements of DOE-STD-1189, *Integration of Safety into the Design Process*, a safety design strategy (SDS) will be developed in accordance with CPCC-PRO-NS-700, *Safety Basis Development,* during this phase of the project. The SDS

describes the interaction between the safety analysis and the design process and identifies safety requirements for the design. The SDS will also be reviewed and updated during the Definitive Design phase of the engineering process.

If the design activity is a modification of a Hazard Category 1, 2, or 3 nuclear facilities, an evaluation shall be performed in accordance with CPCC-PRO-NS-700 to determine if the change is a major modification and affects the existing safety basis of the facility. If the design is determined to be a major modification, a preliminary documented safety analysis (PDSA) is prepared which provides the nuclear safety requirements and criteria the design must meet.

If any design information is initially communicated orally or through informal means, a controlled document shall promptly confirm the transmittal. This ensures that all design communications are accurately documented and traceable, maintaining the integrity of the design process.

Engineering design documentation typically prepared to support the Conceptual Design Phase includes:

- Process flow diagrams (PFD)
- Piping and instrument diagrams (P&ID)
- Conceptual diagrams
- Site plans
- Major equipment identification
- Equipment layout drawings

The conceptual phase design shall be detailed enough to solidify the proposed solution and support development of a rough order of magnitude (ROM) cost and schedule for installation or construction of the design.

For Capital Asset projects performed in accordance with CRD O 413.3B requirements, the project shall include a Conceptual Design Review, in accordance with the projects Project Execution Plan (PEP).

Products resulting from completion of this phase may include:

- PFDs and/or P&IDs (initial release)
- Major equipment identification and layout
- Conceptual Design Report (CDR) as required (see Appendix A)
- Code of Record (Preliminary) as required

3.2.3 Definitive Design Phase

The Definitive Design Phase is performed by the Design Agent and accounts for the remaining design activities up to 90%. This phase may be further subdivided with the design performed up to 60% with a 60% design review, and then to 90% with a final design review.

For Capital Asset projects performed in accordance with CRD O 413.3B requirements, the project shall include Preliminary and Final Design Reviews in accordance with the projects Project Execution Plan (PEP). This requires preparation of a Definitive Design Package to

facilitate the reviews. Formal design reviews require preparation of Definitive Design Packages (see Appendix B) to facilitate reviews.

Completion of this phase means the design is complete enough to proceed with construction or fabrication. The remaining 10% of the design will be completed during construction with generation of field changes and as-building of design documents prior to turnover.

Definitive design continues on where conceptual design ends and involves the more detailed phase of the design process. This phase generally includes the following steps of the engineering design process:

1. Perform Design Analysis and Calculations
2. Develop Design Outputs (drawings, specifications, etc.)
3. Verify Design
4. Release Design

The Design Agent prepares the definitive design in accordance with the design requirements provided by the Design Authority. Definitive design may include any of the following engineering disciplines

:

- Civil
- Structural
- Architectural
- Mechanical/Piping
- HVAC
- Instrumentation
- Electrical
- Fire Protection
- Safety
- Environmental
- Human Factors

This phase includes design analysis typically in the form of engineering calculations for loads, component, and equipment sizing, heating, and cooling, freeze protection, etc. Typical design output documents of this phase include:

- Drawings (plans, sections, elevation, installation, layout, assembly, and details)
- Specifications (equipment, construction, performance, and/or procurement)
- Equipment lists and data sheets
- Control system philosophy and description (including software)

As the design progresses, the safety requirements and documentation are reviewed, updated as required, and incorporated into the design. The review of the design, update of safety requirements, and integration into the design is an iterative process that ensures the design incorporates all identified safety requirements. If the design is subject to the requirements of DOE-STD-1189 and is performed in accordance with a safety design strategy, the SDS is reviewed and updated to ensure the safety requirements are integrated in the design.

Acceptance testing documentation and receipt inspection plans for purchased equipment are prepared during this phase. Acceptance testing documentation is prepared in accordance with CPCC-PRO-EN-286, *Testing of Equipment and Systems*. Testing documentation needed is determined based on the scope of design and rigor required to ensure the design performs as specified.

Definitive design is an iterative phase consisting of peer reviews, design verifications, and formal reviews. Since the design requirements document (e.g., FDC), PFDs, P&IDs, etc. form the basis for this phase of design, they are controlled and disseminated to the Design Agent. Definitive design documents prepared in this phase are in development and are not configuration controlled except in a limited fashion if needed to support formal design reviews. Design documentation issued for design review should utilize an alpha character (“A,” “B,” etc.) to identify the version used in the review.

During definitive design, design reviews and verification are performed as needed. The type of design review and verification is dependent upon the scope and complexity of the design and can range from a simple peer review to a formal design review. The results of the review/ verification shall be incorporated into the remaining design as agreed upon by the Design Agent and Design Authority. Design verification is performed in accordance with CPCC-PRO-EN-8336, *Design Verification*.

The Design Agent shall continue with design until the design is considered complete. At this point, a final design verification is performed. The results of this verification shall also be incorporated into the design as agreed upon.

Upon completion of the final design, the design is considered complete and ready for construction or fabrication. The design output documents shall be approved and released or issued for construction. Design documentation developed for a construction project is **issued** for construction in accordance with CPCC-PRO-EN-8016, *Design Change Notice Process*. Design documents issued for facility modifications are **released** in accordance with CPCC-PRO-EN-2001.

Products resulting from completion of this phase may include:

- 60% Design Package (i.e., Preliminary Design) as required (see Appendix B)
- Final (90%) Design Package if required (see Appendix B)
- Initial release or issue of design documents

3.2.4 Engineering During Construction Phase

Once issued or released, the design documents are ready to be used for construction, fabrication, or equipment purchasing. Design output documents used for construction, fabrication, or equipment purchasing are provided to the construction organization or included in an EP.

Engineering during Construction is provided by the Design Authority and Design Agent working together to address design and technical questions and issues. This phase includes the following steps of the engineering design process:

1. Install Design
2. Test Design
3. As-Build Design Documentation

Design Agent support is frequently needed during the construction phase of the project to interpret design requirements, correct design errors, or make requested changes. Field conditions sometimes require changes to design output documents. Changes can range from simple fixes to significant analysis and redesign.

Design documentation is configuration controlled to ensure changes are reviewed and approved with the same rigor as the original document. Construction projects control changes to issued engineering documentation using a design change notice (DCN) prepared and processed in accordance with CPCC-PRO-EN-8016. Facility modification changes are made using EPs in accordance with CPCC-PRO-EN-2001.

Changes to design inputs, final designs, field changes, temporary and permanent modifications to operating facilities shall be justified and subject to design control measures commensurate with those applied to the original design. These measures shall include evaluation of the effects of those changes on the overall design and on any analysis upon which the design is based. The evaluation shall include facility configurations that occur during operation, maintenance, test, surveillance, and inspection activities.

Changes shall be subject to the same review and approval requirements of the original design documents. When the organization originally responsible for review and approval of the original design documents (i.e. design subcontractor) is no longer responsible, the owner or their designee shall have responsibility or designate a new responsible organization. The design organization approving the change shall have demonstrated competence in the specific design area of interest and have an adequate understanding of the requirements and intent of the original design.

Once installed, acceptance testing is performed to ensure that the SSC performs in accordance with the design requirements and performance specifications. During testing, conditions determined to be out of specification may also require redesign and retesting. Changes to design and testing documentation are also controlled in accordance with CPCC-PRO-EN-8016 and CPCC-PRO-EN-2001 as appropriate.

When installation/construction/fabrication and testing are complete, the Design Authority will ensure field verification is performed. Discrepancies between the design documentation and field configuration shall be addressed by either correcting the field condition(s) or processing a change to the design document. Field verification and as-building are performed in accordance with CPCC-PRO-EN-8017, *As-Built Verification Process*. When completed, the field configuration and design documents should be in agreement. At this time, the design is considered to be “as-built.”

Upon completion of the phase, the SSC is installed, acceptance tested, and all design documentation has been as-built to reflect the actual field conditions. The project or modification is ready to be turned over to Operations for beneficial use.

3.2.5 Turnover and Closeout Phase

The SSC installed during design is turned over when Operations accepts the SSC for beneficial use and places it in operational status. The final step in the design process is for the Design Authority to ensure the appropriate design documentation is released into the Document Management and Control System (DMCS), revised, and/or identified as part of the configuration baseline for the installed or modified SSC.

Turnover and Closeout phase includes the following steps of the engineering design process:

1. Accept Design (Operations)
2. Update Technical Baseline (Design Authority)
3. Formal release of design documentation into DMCS

For construction projects, the turnover process is defined by the project; for modifications, the process is defined in CPCC-PRO-EN-2001 and CPCC-PRO-WKM-12115, *Work Management,* (for closeout of the Job Control System [JCS] work package containing the EP).

The method for updating the technical baseline differs between construction projects and facility modifications:

- Construction projects will release design documentation into DMCS using an EP or DMCS Change Notice as described in CPCC-PRO-EN-2001. The Design Authority for the operating SSC installed by the design will review the project design documentation and identify which documents are to be released into DMCS for operational and configuration management of the SSC. This documentation will include essential and support drawings as well as other engineering documentation. The project is then closed out according to the close-out process defined by the project.
- For facility modifications, the EP is closed out, new drawings are released, and drawing revisions are performed. Essential and support drawing revision shall be performed in accordance with the schedule identified in CPCC-PRO-EN-20050, Engineering Configuration Management.

3.3 STEPS OF THE ENGINEERING DESIGN PROCESS

In addition to the phases of an engineering design process, the engineering design goes through a number of steps. Some of the steps are performed within specific phases while other steps are performed across phases or within more than one phase.

The steps performed in a typical engineering design are as follows:

1. Identification of Need for Engineered Design
2. Request for Design
3. Initiate Design (assign Design Authority)
4. Identify Design Inputs
5. Perform Design Analysis
6. Develop Design Outputs
7. Verify Design
8. Release Design
9. Install Design
10. Test Design
11. As-Build Design
12. Accept Design
13. Update Technical Baseline

The engineering design process can be performed in-house or subcontracted out to offsite architectural/engineering firms. Regardless of the method of execution, the general steps described in this section should be followed to produce an adequate design and installation.

Design interfaces (both equipment interfaces and organizational responsibility) shall be identified and controlled (review, approval, release, distribution and revision) throughout all steps of the engineering design process.

An engineering design typically includes these engineering functions:

- Design Authority
- Design Agent
- Design Verifier
- Testing Personnel
- Field Verifiers

3.3.1 Initiate Design

The design process starts with a request for engineering design services. The scope of this service can range from a simple facility modification to support of a capital construction project. Regardless of the scope, the following steps for initiating an engineering design process are performed.

Actionee	*Step*	*Action*
Engineering Manager	1.	RECEIVE request for engineering design services.
	2.	ASSIGN a Design Authority to oversee the engineering design task.
Design Authority	3.	REVIEW the request, ESTABLISH the scope of the engineering design, AND IDENTIFY Design Agent engineering discipline needs.

3.3.2 Identify Design Inputs

The Design Authority reviews the request, identifies the scope, and prepares the design requirements which includes functional requirements, technology needs, applicable codes and standards, and constraints applicable to the design. The design requirements are documented in a standalone document (e.g., an FDC) or identified in an EP.

Design inputs which form the basis and requirements of a design typically include:

- Functional and performance requirements of the design
- Specific codes and standards applicable to the design (local, state, and regional codes and national consensus standards)
- Existing conditions affecting the design (e.g., interfaces with existing SSCs and utilities, building configuration and construction, environmental and operational limitations)
- Design constraints (regulatory, permitting, waste generation allowance, hazard minimization)
- Quality standards to be met
- Hazards and Safety requirements
- Natural phenomena hazard design criteria
- Future expansion requirements
- Fire protection requirements
- Requirements for SSC tagging and identification
- Human factors
- Maintenance requirements
- Deactivation and decommissioning (D&D) requirements

Actionee	*Step*	*Action*
Design Authority	1.	IDENTIFY the design requirements to be implemented in the design.
	2.	DOCUMENT the design requirements in a standalone design requirements document (e.g., FDC) or an EP in accordance with CPCC-STD-EN-40255, *Design Requirements Documentation*.
	3.	OBTAIN reviews, approvals, AND ENSURE the design requirements document or EP are released into DMCS.
	4.	PROVIDE a copy of the design requirements documentation to the Design Agent.

3.3.3 Perform Design Analysis

Design analysis prepared in support of the design is typically performed by the Design Agent. These may include calculations, engineering analysis, studies, etc.

Calculations are performed for specific system, equipment, or component performance or sizing. Calculations shall be prepared in accordance with CPCC-STD-EN-40259, *Engineering Calculations,* and shall be checked by a qualified individual other than the preparer.

Examples of calculations include:

- Process system performance and throughput
- System loading and performance (electrical power, heating and cooling loads)
- Structural loading
- Equipment sizing and support

Engineering analyses shall be sufficiently detailed such that a person technically qualified in the subject can review and understand the analyses and verify the adequacy of the results without recourse to the originator.

Engineering analysis and studies shall be performed as required to determine feasibility, best options for the design, uses of technology, siting conditions, environmental impacts, etc.

The Design Agent will determine the types of design analysis needed to support the design. The Design Authority may also identify required studies or analysis to be performed by the Design Agent. Engineering analysis and studies shall use a format appropriate for the type of activity performed.

Actionee	*Step*	*Action*
Design Authority/ Design Agent	1.	IDENTIFY design analysis (calculations, engineering analysis, engineering studies, etc.) needed to support the design.
Design Agent	2.	PERFORM the design analysis AND DOCUMENT the results. • Calculations shall be prepared in accordance with CPCC-STD-EN-40259. • Engineering analysis and studies shall be prepared in accordance with CPCC-PRO-EN-440.

3.3.4 Develop Design Outputs

Design output documents are prepared by the Design Agent and are the end product of the engineering design process. Design output documents identify the requirements for installation, construction, fabrication, and testing of the SSC. They are also used to perform verification of the design against design requirements. Typical design output documents include:

- Drawings
- Specifications (construction, procurement, performance, etc.)
- Equipment data sheets
- Acceptance test documentation
- Control system description
- System design descriptions

The Design Agent develops the design output documentation needed to support and install the design. Design output documentation is prepared in accordance with CPCC-PRO-EN-440, *Engineering Documentation Preparation and Control*.

Acceptance testing is also planned during this step and acceptance test documentation is prepared to test acceptability of the installed SSC to perform its design functional requirements. Acceptance testing documentation shall be prepared in accordance with CPCC-PRO-EN-286. Acceptance test documentation may include any one or combination of the following:

- Acceptance test plan
- Acceptance test specification
- Acceptance test procedure
- Acceptance test report

Acceptance testing requirements shall be based on the complexity of the design. Acceptance testing includes functional performance of the installed SSC, equipment performance, and control functionality. Acceptance testing also includes factory acceptance tests (FAT) and construction acceptance tests (CAT) as described in CPCC-PRO-EN-286.

For nuclear applications, a commercial grade item modified or selected by special inspection and/or testing to requirements that are more restrictive than the supplier's published product description shall be represented as different from the supplier's commercial grade item in a manner traceable to a documented definition of the difference. This representation shall be captured in the appropriate design output document.

Actionee	*Step*	*Action*
Design Agent	1.	IDENTIFY design output documentation (drawings, engineering analysis, engineering studies, etc.) needed to support the design.
	2.	PREPARE the design output documents which incorporate design requirements. • Design documentation shall be prepared in accordance with CPCC-PRO-EN-440.

3.3.5 Verify Design

Design verification is performed in accordance with CPCC-PRO-EN-8336. Design verification evaluates the completed design to determine if it implements the requirements defined with the FDC.

The type of verification performed is established by the Design Authority and/or Design Agent. The methods of verification are:

- Peer Review
- Alternate Calculations
- Qualification Testing
- Formal Design Review

Verification can be performed using one or any combination of the verification methods and can be performed at various points during the design process. The verification method chosen is based upon the scope and complexity of the design. Simple facility modifications typically use the Peer Review method. Verification for construction projects or complex modifications may include Formal Design Reviews for 30/60/90 design completion milestones. Formal Design Reviews shall be performed in accordance with CPCC-PRO-EN-40264, *Formal Design Review*.

Actionee	*Step*	*Action*
Design Authority	1.	ESTABLISH the appropriate design verification method(s) to be used for the design.
	2.	IDENTIFY the design verification personnel AND ENSURE they possess the necessary qualifications and independence required by the appropriate verification method.
Design Agent	3.	SUPPORT the design verification by providing design output documents to the verifier(s).
Design Verifier(s)	4.	PERFORM design verification per the method established by the Design Authority. • Design verification shall be performed in accordance with CPCC-PRO-EN-8336 for the selected verification method.
	5.	VERIFY design methods, materials, parts, equipment, and processes that are essential to the function of the SSC or computer software for suitability of application.

3.3.6 Release Design

Design output documents prepared for a construction project are released with a DCN in accordance with project directions and CPCC-PRO-EN-8016.

Drawings for facility modifications are released with an EP. Other non-drawing design output documents (engineering text documents) may be standalone or included with an EP. Release of standalone documents shall be in accordance with CPCC-PRO-EN-440. Inclusion with an EP shall be in accordance with CPCC-PRO-EN-2001.

Actionee	*Step*	*Action*
Design Authority / Design Agent	1.	REVIEW AND APPROVE the design output documents. • Design output documents issued for Formal Projects are reviewed and approved per project direction and CPCC-PRO-EN-8016. • Design output documents for Facility Modifications are reviewed and approved with an EP in accordance with CPCC-PRO-EN-2001. • Standalone documents shall be reviewed and approved in accordance with CPCC-PRO-EN-440.
	2.	PREPARE the release authorizing documentation for the design output documents. • For construction projects – DCNs prepared in accordance with CPCC-PRO-EN-8016. • For facility modifications – EPs prepared in accordance with CPCC-PRO-EN-2001. • For standalone design output documents – EPs prepared in accordance with CPCC-PRO-EN-440.
	3.	SUBMIT the design output documentation and release authorizing document to the proper issuing/release organization for release or issue. a. For construction projects, PROVIDE the documentation to the Project Technical Services (PTS) Construction Document Control organization. b. For facility modifications, PROVIDE the documentation to the Information Resource Management (IRM) Release Station.

3.3.7 Install Design

During the course of installation, construction, or fabrication the Design Agent may be called upon to answer questions or provide clarification. In addition, field conditions, part/component/ equipment changes, and design errors may require additional or re-design. These changes are configuration controlled to ensure the construction force has the correct version of the design.

Design changes for construction projects are controlled in accordance with CPCC-PRO-EN-8016. A DCN is approved and issued prior to proceeding with the change.

Design changes for facility modifications are controlled in accordance with CPCC-PRO-EN-2001. An EP change or EP revision is approved and released prior to proceeding with the change.

Actionee	*Step*	*Action*
Design Agent	1.	PROVIDE support to construction forces by answering questions or providing clarification on the design.
	2.	EVALUATE field conditions, equipment changes, or requests for changes to determine if a change to the design is warranted or required.
	3.	IF a design change is needed, THEN PREPARE changes to design output documents as needed to address the change.
	4.	PREPARE change authorizing documentation. • Construction projects – PREPARE a DCN in accordance with CPCC-PRO-EN-8016. • Facility modifications – PREPARE an EP or revision in accordance with CPCC-PRO-EN-2001. • Standalone engineering documentation – PREPARE an EP in accordance with CPCC-PRO-EN-440.
	5.	REVIEW AND APPROVE the design change documents.
	6.	SUBMIT the design output documentation and change authorizing documentation to the proper issuing/release organization for release or issue. a. Construction projects – PROVIDE the DCN to the Construction Document Control organization. b. Facility Modifications or Standalone Documents – PROVIDE the documentation to the Hanford Document Control and Records Support

3.3.8 Test Design

When installation of the design is complete, acceptance testing is performed to ensure the installed SSCs meet the functional requirements and are performing as specified. Acceptance testing documentation previously prepared shall be used to perform acceptance testing. Acceptance testing shall be performed in accordance with the testing documents and CPCC-PRO-EN-286.

Actionee	*Step*	*Action*
Testing Personnel	1.	PERFORM acceptance testing of the installed design as described in the acceptance test documentation. • Acceptance testing shall be conducted in accordance with CPCC-PRO-EN-286.
Design Authority/Test Coordinator	2.	REVIEW AND APPROVE the acceptance testing results and documentation.
	3.	SUBMIT the approved acceptance test results and release authorizing documentation to the proper issuing/release organization for release or issue. a. Construction projects -- PROVIDE the completed test documentation and DCN to the Construction Document Control organization. b. Facility modifications -- PROVIDE the completed test documentation and EP to the IRM Release Station, OR INCLUDE within the associated JCS Work Package.

3.3.9 As-Build Design

When the design is installed and tested, the design output documentation is walked down and field verified to ensure the field configuration and documentation are in agreement. Field verification and as-building shall be performed in accordance with CPCC-PRO-EN-8017.

Discrepancies discovered between the field configuration and design documentation require review by the Design Authority and Design Agent to determine if the field configuration needs to be corrected or the design documentation needs to be changed.

As-built changes to design documents for construction projects are controlled in accordance with CPCC-PRO-EN-8016. A DCN is issued to update design documentation with as-built changes.

As-built changes for facility modifications are controlled in accordance with CPCC-PRO-EN-2001. An EP revision is prepared and released to update design documentation with as-built changes.

Actionee	*Step*	*Action*
Design Authority	1.	IDENTIFY design output documents to be field verified AND ESTABLISH expectations for field verification of engineering documentation in accordance with CPCC-PRO-EN-8017.
	2.	IDENTIFY the Field Verification Team.
Field Verification Team	3.	PERFORM field verification in accordance with CPCC-PRO-EN-8017. • Field verification shall be performed to the rigor established by the confidence level required.
	4.	NOTIFY Design Authority and Design Agent of discrepancies between the field conditions and engineering documentation.
Design Authority / Design Agent	5.	REVIEW discrepancies AND DETERMINE required actions. a. IF determined that design documentation needs to be changed, THEN PREPARE AND APPROVE the appropriate change documentation as follows: • DCNs per CPCC-PRO-EN-8016 • EP per CPCC-PRO-EN-2001 or CPCC-PRO-EN-440
Design Authority / Design Agent	6.	SUBMIT the as-built design documentation and change authorizing documentation to the proper issuing/release organization for release or issue. a. For construction projects -- PROVIDE the as-built documentation and DCN to the Construction Document Control organization. b. For facility modifications -- PROVIDE the as-built documentation and EP to the Hanford Document Control and Records Support.

3.3.10 Accept Design

When installation, acceptance testing, and as-building are complete, the installed SSC is ready for turnover to Operations. Operations will review the installed SSC and relevant documentation prior to accepting the SSC.

During acceptance, Operations may require that additional changes or corrections to the installed SSC or design document be made prior to their acceptance. Any changes required at this point are still under the same configuration control methodology used for the design:

- Changes required by Operations for construction projects are controlled in accordance with CPCC-PRO-EN-8016 using the DCN process.
- Changes required by Operations for facility modifications are controlled in accordance with CPCC-PRO-EN-2001 using the EP process.

Actionee	*Step*	*Action*
Operations Management	1.	REVIEW installed SSC and design documentation for turnover and acceptance. a. IDENTIFY if changes or corrections are needed to the design prior to acceptance. b. IF required, THEN PROVIDE the changes/corrections to the Design Authority.
Design Authority/ Operations Management	2.	AGREE upon proposed changes to allow Operations acceptance.
Design Authority/ Design Agent	3.	REVIEW changes/corrections requested by Operations AND DETERMINE scope and impact upon design documentation.
Design Agent	4.	IF a design changes or corrections are needed, THEN PREPARE changes/corrections to design output documents as needed.
Design Agent	5.	PREPARE change authorizing documentation. • For construction projects – PREPARE a DCN(s) in accordance with CPCC-PRO-EN-8016. • For facility modifications – PREPARE an EP(s) in accordance with CPCC-PRO-EN-2001. • For standalone documents – PREPARE an EP(s) in accordance with CPCC-PRO-EN-440.
Design Authority/ Design Agent	6.	REVIEW AND APPROVE the design change documentation.

Actionee	*Step*	*Action*
Design Authority/ Design Agent	7.	SUBMIT the design documentation and change authorizing documentation to the proper issuing/release organization for release or issue. a. For construction projects -- PROVIDE the documentation and DCN to the Construction Document Control organization. b. For facility modifications -- PROVIDE the documentation and EP to the Hanford Document Control and Records Support
Operations Management	8.	WHEN satisfied, THEN ACCEPT installed or modified SSC for beneficial use.

3.3.11 Update Technical Baseline

Once accepted and turned over to Operations, the installed SSC is managed as an operating SSC. Operations and Engineering will have determined if the installed SSC is to be a configuration managed structure, system, or component (CM SSC). CM SSCs are placed under configuration management, have an assigned Design Authority assigned, and a configuration baseline established in DMCS per the requirements of CPCC-PRO-EN-20050.

Construction project design documentation managed in accordance with the project direction and CPCC-PRO-EN-8016 may or may not have been managed using DMCS. However, until the project is closed out and turned over to Operations, the project engineering documentation has not yet been formally released into DMCS. To formally release this design documentation, either an EP or DMCS Change Notice is required as described in CPCC-PRO-EN-2001. Project design documentation not released into DMCS will continue to be available in the project record file if needed.

The Design Authority assigned to the installed SSC shall review the project engineering documentation and determine which documents are required for technical support for operation of the SSC and need to be formally released into DMCS. The Design Authority will also identify and designate essential and support drawings for the SSC.

For facility modifications, new design documents shall be released into DMCS upon work completion of the EP per CPCC-PRO-EN-2001. Revised documents shall be revised within the configuration baseline document update schedule established in CPCC-PRO-EN-20050.

Actionee	*Step*	*Action*
Design Authority	1.	REVIEW the design documentation managed by the construction project to determine which are needed to manage operation of the installed SSC.
	2.	IDENTIFY essential drawings, support drawings, and other configuration baseline documents to be released into DMCS.
	3.	DEVELOP an EP or DMCS Change Notice in accordance with CPCC-PRO-EN-2001 to formally release construction project engineering design documentation into DMCS.
	4.	IDENTIFY drawings to be essential or support as needed.
Engineering Manager/ Design Authority	5.	REVIEW AND APPROVE the FMP.
Design Authority	6.	SUBMIT the approved EP or DMCS Change Notice and associated engineering design documentation (as needed) to DMCS for release and record retention.

4.0 FORMS

None

5.0 RECORD IDENTIFICATION

All records are generated, processed, and maintained in accordance with CPCC-PRO-IRM-10588, *Records Management Processes*.

Records created during the performance of OCRWM activities shall be managed and additionally submitted to the OCRWM Records Coordinator, in accordance with CPCC-PRO-QA-19579, *OCRWM Records Management*.

Records Capture Table

Name of Record	Submittal Responsibility	Retention Responsibility
Design Basis/Requirements Documents (e.g., FDC)	Design Authority	IRM Service Provider
Design Requirements Documents (e.g., FDC) (OCRWM)	Design Authority	OCWRM Records Coordinator
Design Output Documents (Drawings/Specifications, etc.)	Design Authority/Design Agent	IRM Service Provider
Design Output Documents (Drawings/Specifications, etc.) (OCWRM)	Design Authority/Design Agent	OCWRM Records Coordinator
Acceptance Test Documentation	Design Authority/Design Agent	IRM Service Provider
Acceptance Test Documentation (OCWRM)	Design Authority/Design Agent	OCWRM Records Coordinator
Conceptual Design Report (CDR)	Design Authority/Design Agent	IRM Service Provider
Conceptual Design Report (CDR) (OCWRM)	Design Authority/Design Agent	OCWRM Records Coordinator
Definitive Design Package	Design Authority/Design Agent	IRM Service Provider

Name of Record	Submittal Responsibility	Retention Responsibility
Definitive Design Package (OCWRM)	Design Authority/Design Agent	OCWRM Records Coordinator
Change Authorization Documents (EP/DCN)	Design Authority/Design Agent	IRM Service Provider
Change Authorization Documents (EP/DCN) (OCWRM)	Design Authority/Design Agent	OCWRM Records Coordinator

6.0 SOURCES

6.1 REQUIREMENTS

CPCC-MP-QA-599, *Quality Assurance Program*
CPCC-RD-EN-1819, *Engineering Requirements*

6.2 REFERENCES

CRD-O-413.3B, *Program and Project Management for the Acquisition of Capital Assets*
DOE-STD-1189, *Integration of Safety into the Design Process*
CPCC-MP-PM-53011, *CPCCo Project Management Plan*
CPCC-PRO-EN-2001, *Facility Modification Package Process*
CPCC-PRO-EN-20050, *Engineering Configuration Management*
CPCC-PRO-EN-286, *Testing of Equipment and Systems*
CPCC-PRO-EN-40264, *Formal Design Review*
CPCC-PRO-EN-440, *Engineering Documentation Preparation and Control*
CPCC-PRO-EN-8016, *Design Change Notice Process*
CPCC-PRO-EN-8017, *As-Built Verification Process*
CPCC-PRO-EN-8336, *Design Verification*
CPCC-PRO-IRM-10588, *Records Management Processes*
CPCC-PRO-NS-700, *Safety Basis Development*
CPCC-PRO-QA-19579, *OCRWM Records Management*
CPCC-PRO-WKM-12115, *Work Management*
CPCC-STD-EN-40255, *Design Requirements Documentation*
CPCC-STD-EN-40259, *Engineering Calculations*
CPCC-STD-EN-40279, *Engineering Drawing Standards*

6.3 BASES

CPCC-GD-EN-40256, *Engineering Codes and Standards*
CPCC-STD-PM-53012, *Project Categorization And Tailoring*
CPCC-STD-PM-53013, *Project Closeout*
CPCC-STD-PM-53014, *Project Execution Plans*

Appendix A - Conceptual Design Report (CDR) Template

Conceptual Design Reports (CDR) are typically required for formal projects or when required by the customer. This requires preparation of a Conceptual Design Report.

The template below provides a suggested format and content for preparation of a CDR. CDRs are tailored to include only relevant elements of the design.

CPCCo CDRs is prepared and controlled as supporting documents in accordance with CPCC-PRO-EN-440, *Engineering Documentation Preparation and Control*.

1.0 INTRODUCTION

1.1 BACKGROUND

Provide background information relevant to the design and associated facilities/systems.

1.2 DESIGN SCOPE AND PERFORMANCE

Define the purpose and scope for the design. Identify the roles and responsibilities for design performance, review and approvals, and end-user acceptance.

2.0 DESIGN/PROCESS SELECTION

2.1 SUMMARY OF FUNCTIONAL AND DESIGN REQUIREMENTS

Summarize the design requirements (i.e., functional, performance, and operational requirements) which provide the basis for the design.

2.2 DESIGN ALTERNATIVES

Identify and describe the alternatives considered for the design and/or various elements of the design.

2.3 SELECTION CRITERIA

Identify the selection criteria used for evaluation of the design alternatives. Selection criteria are based on functional requirements, design constraints, project cost and schedule constraints, etc. A quantitative method of selection based on categorical ratings may be used. For technically complex projects, technological risk and readiness should be analyzed and included in the criteria.

2.4 SELECTION OF PREFERRED DESIGN ALTERNATIVE(S)

Summarize the analysis of each alternative against the selection criteria to provide a justifiable selection for the design/process to be developed through formal design, construction, and operation.

Appendix A - (Cont.)

3.0 DESIGN OVERVIEW

Provide a general summary of the selected design and describe how it will implement the design requirements. Include the following elements as appropriate.

3.1 INTERFACES WITH EXISTING FACILITIES/SYSTEMS

Provide details concerning issues and strategies associated with tie-ins to existing Hanford utilities (HMIS), Hanford services (HMIS), and facility infrastructure.

3.2 NUCLEAR SAFETY

Identify specific elements to be included and processes employed during design to comply with DOE-STD-1189, *Integration of Safety into the Design Process*.

3.3 OPERATIONS INTEGRATION

Describe details requiring further development to ensure that the designed system will be operable by the end user.

3.4 MAINTENANCE REQUIREMENTS

Identify maintenance requirements needed for equipment and components installed by the design.

4.0 CONCEPTUAL DESIGN

Describe design elements to be developed that will implement the selected design alternative. Reference design documentation as necessary. This section is typically arranged by engineering/functional discipline. Elements of this section not used or applicable to the design can be omitted.

4.1 PROCESS ENGINEERING

Describe the overall process design including production requirements and constraints. The following should be included:

4.1.1 Process Flow Diagram (PFD) with Preliminary Mass/Energy Balance

4.1.2 Process and Instrumentation Diagram (P&ID)

Any issues related to new technology or long-lead procurement items should be discussed.

Appendix A - (Cont.)

4.2 CIVIL ENGINEERING

4.2.1 Site Plan -- Site plans are developed showing new or existing facilities, location of system installation, roads, storage or laydown areas for materials during construction, etc.

4.2.2 Geotechnical -- Provide a discussion of geotechnical issues, including areas of further study/development as required.

4.2.3 Utility Interfaces -- Steam, Water, Sewer, Roads/Transportation, etc.

4.3 STRUCTURAL ENGINEERING

Details of foundations and footings for buildings, skids, and or large equipment should be provided and discussed. Describe details for major structures.

4.4 MECHANICAL ENGINEERING

Describe major mechanical systems and equipment including process equipment described in Section 4.1. Major equipment should be depicted on the PFD and P&ID. Any issues related to new technology or long-lead procurement items should be discussed. The following information should also be included.

4.4.1 Preliminary Equipment Sizing -- Equipment data for major equipment.

4.4.2 Preliminary Equipment Layout -- Equipment layout and location.

4.5 ELECTRICAL ENGINEERING

Preliminary electrical power requirements for the facility and major equipment should be identified. Supply points and tie-ins can also be identified. The following elements should be provided:

4.5.1 One-Line Diagram -- Preliminary one-line diagrams showing facility and equipment power supply.

4.5.2 Site Power Plan -- Site power plans showing power source(s) (may be integrated with the civil site plan).

4.6 INSTRUMENTATION & CONTROLS

Describe the overall instrumentation, controls, and data acquisition strategy for the system/facility. Describe the I&C technologies expected to be used. Preliminary design of the I&C loop diagrams should be provided. Include and discuss the following as appropriate:

4.6.1 I&C Block Diagrams

Appendix A - (Cont.)

4.6.2 I&C Loop Diagrams

4.7 MECHANICAL FACILITY SYSTEMS (HVAC, PIPED SYSTEMS, ETC.)

Describe the overall design for the HVAC system. For nuclear HVAC systems, how the design integrates with and satisfies the Safety Design Strategy should be described. Describe the overall design of piped systems (e.g., water supply, sewer, gas supply, etc.).

4.8 FUNCTIONAL ELEMENTS

Applicable functional elements are discussed in the CDR with respect to how they are integrated into the facility/system design. Reference design documentation as necessary. Functional Elements include the following as appropriate for the design:

4.8.1 Fire Protection – describe fire protection and life safety code design elements and implementation.

4.8.2 Worker Health & Safety – describe industrial health and safety design elements and implementation.

4.8.3 Radiological Control – describe radiological control and ALARA design elements and implementation.

4.8.4 Emergency Response -- describe emergency response design elements and implementation.

4.8.5 Environmental – describe environmental protection design elements and implementation.

4.8.6 Safeguards & Security – describe Safeguards & Security design elements and implementation.

4.8.7 Criticality Safety – describe the criticality safety strategy, design elements, and implementation.

4.8.8 Transportation Safety – describe design elements required for transportation safety.

4.8.9 Quality Assurance – identify Quality Assurance and Quality Control elements needed for the design.

5.0 DESIGN COMPLETION STRATEGY

Describe items needed for design completion including:

- Tasks, actions, and resources needed to complete the design.
- Provide an overview of the design documentation needed for the complete design.

Appendix A - (Cont.)

- Describe long lead procurement items.
- Describe any technology development needs required for the design.

6.0 DESIGN REPORT DOCUMENT INVENTORY

List the design documentation produced for the conceptual design and included in the report. This includes as appropriate:

- Site Civil Plan
- Calculations and analysis
- Process Flow Diagrams (PFD)
- Process & Instrumentation Diagrams (P&IDS)
- Major equipment identification and data sheets
- Major equipment Layout
- Code of Record (as required)
- Design and Construction Schedule
- Design and Construction Cost Estimate

Engineering drawings and documentation that is in development are issued using letter revisions (e.g., A, B, C). Finalized, approved engineering documentation uses standard numerical revision numbers.

Appendix B - Definitive Design Package Template

Definitive Design reviews are typically required for formal projects or when required by the customer.

A Definitive Design Package includes a report of the design implementation and status plus the design documentation produced for the current state of the design. The following provides a suggested template for preparation of a Definitive Design Package. Design Packages are tailored to include only relevant elements of the design.

CPCCo Definitive Design Packages are prepared and controlled as supporting documents in accordance with CPCC-PRO-EN-440, Engineering Documentation Preparation and Control. Design Packages prepared by third party vendors may vary but should have similar elements to this template.

1.0 INTRODUCTION

1.1 BACKGROUND

Provide background information relevant to the design and associated facilities/systems.

1.2 DESIGN SCOPE AND PERFORMANCE

Define the purpose and scope for the design. Identify the roles and responsibilities for design performance, review and approvals, and end-user acceptance.

Discuss the progress and current status of the design.

2.0 DESIGN PROGRESS AND STATUS

Summarize the current state of the design and identify further activities necessary to complete the design. For the Final Design Report (FDR), this simply summarizes the design.

Discuss any open issues regarding the design. Describe any qualification testing performed or needed to verify design elements.

3.0 DESIGN OVERVIEW

Provide a general summary of the current design status and progress, open issues, and remaining tasks.

3.1 INTERFACES WITH EXISTING FACILITIES/SYSTEMS

Summarize identified interfaces and proposed tie-ins.

3.2 NUCLEAR SAFETY

Provide an overview of Structures, Systems, and Components (SSC) that provide a safety function, briefly describe the safety function, and identify the safety classification of SSCs if known.

Appendix B - (Cont.)

3.3 OPERATIONS INTEGRATION

Describe design details employed which ensure that the design will be operable by the end user.

3.4 MAINTENANCE REQUIREMENTS

Identify maintenance requirements needed for equipment and components installed by the design.

4.0 DESIGN

Provide design details describing the current state of the design and how it meets the design requirements. Reference design documentation as necessary. Open issues should be identified. Details for specific engineering / functional area should be discussed specifically as needed. Elements of this section not used or applicable to the design are omitted.

4.1 PROCESS ENGINEERING

Describe the overall process design including design production and throughput, process steps, control, constraints, operation, etc. A general discussion of the mass/energy balance and process flow diagram(s) should be included. General system controls and instrumentation should be described. Process Flow Diagrams (PFD) and Process and Instrumentation Diagrams (P&ID) are included as appropriate.

The discussion should make it clear how the design meets the design requirements.

4.2 CIVIL ENGINEERING

4.2.1 Site Plan – describe the required site elements needed for or affected by the design. Discuss new facilities or existing facilities, location of installation, utilities, and all support entities such as roads, storage, laydown areas for construction, etc.

4.2.2 Geotechnical – describe any geotechnical issues which are incorporated in the design.

4.2.3 Utility Interfaces – describe the utilities and interfaces incorporated into the design.

4.3 STRUCTURAL ENGINEERING

Describe all structural engineering elements and details (e.g., foundations and footings, structural elements for buildings, skids, large equipment placement and support, etc.

Appendix B - (Cont.)

4.4 MECHANICAL ENGINEERING

Provide discussion of design details regarding mechanical systems and equipment, in conjunction with the process discussion from Section 4.1, as depicted on the PFD and P&ID. In addition, issues related to new technology or long-lead procurement items should be discussed. The following should be included in the discussion.

4.4.1 Equipment Sizing – Equipment data for equipment.

4.4.2 Equipment Layout – Equipment layout and location.

4.5 ELECTRICAL ENGINEERING

Describe electrical power, capacity, and routing design. Identify required supply and tie-in points. Identify new services to be provided by Site Electrical Utilities. Discuss the design shown on the following:

4.5.1 One-Line Diagram(s)

4.5.2 Site Power Plan

4.6 INSTRUMENTATION AND CONTROLS (I&C)

Describe the function and operation of the instrumentation and controls used for the design. Identify the hardware and software to be used for the control system. Identify control system software development requirements if needed. Provide the following design elements as needed.

4.6.1 I&C Block Diagram

4.6.2 I&C Loop Diagrams

4.7 MECHANICAL FACILITY SYSTEMS (HVAC, PIPED SYSTEMS, ETC.)

Describe the mechanical systems provided by the design. Identify the HVAC system design and how it satisfies the design requirements. Discuss other mechanical systems included in the design (e.g., water supply, sewer, gas, etc.)

4.8 FUNCTIONAL ELEMENTS

Describe how the design meets applicable functional elements required for the design. Elements appropriate to the design are be described and discussed in the report. Elements include the following as appropriate for the design:

4.8.1 Fire Protection – describe fire protection system and life safety design features.

4.8.2 Worker Health and Safety -- describe industrial health and safety design elements.

Appendix B - (Cont.)

4.8.3 Radiological Control -- describe radiological control and ALARA design elements and implementation.

4.8.4 Emergency Response -- describe emergency response design elements.

4.8.5 Environmental – describe design features implemented for environmental protection requirements.

4.8.6 Safeguards and Security -- describe Safeguards & Security design elements.

4.8.7 Criticality Safety – describe criticality system design, detection, and alarms.

4.8.8 Transportation Safety – describe design elements required for transportation safety.

4.8.9 Quality Assurance – describe Quality Assurance and Quality Control elements needed for implementation of the design.

5.0 DESIGN COMPLETION STRATEGY

For a 60% Design Package, identify any further testing, analysis, modeling, and additional design work to be performed to complete the design.

For a 90% Design Package, state that the design will be finalized pending final disposition of open design review comments.

6.0 DOCUMENT INVENTORY

Include as appropriate:

- Diagrams and Drawings
- Calculations and analysis
- Equipment Data Sheets
- Equipment and Construction Specifications
- System Design Description
- Control System Design Description
- Test Plans/Specifications/Procedures
- Supporting Documents
- Safety Equipment List (as required)

Appendix B - (Cont.)

- Code of Record (as required)

Engineering drawings and documentation that is in development are issued using letter revisions (e.g., A, B, C). Finalized, approved engineering documentation uses standard numerical revision numbers.