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TABLE OF CONTENTS

1.0 PURPOSE AND SCOPE 2
2.0 IMPLEMENTATION 2
3.0 RESPONSIBILITIES 3
4.0 GUIDANCE 3
 4.1 Design Review Scheduling 3
 4.2 Preparation for Design Reviews 3
 4.3 Conduct of Design Review 5
5.0 DEFINITIONS 6
6.0 RECORDS 6
7.0 REFERENCES 6

TABLE OF ATTACHMENTS

ATTACHMENT A – GUIDANCE FOR DESIGN AGENCY “KICK-OFF” AND FOLLOW-ON
 MEETINGS 7
ATTACHMENT B – DESIGN REVIEW MILESTONE GUIDELINES 9

1.0 PURPOSE AND SCOPE

This guidance document provides the tools and methodology for the performance of team design reviews. Design reviews performed in accordance with this guidance are intended for the purpose of monitoring status and **not** to perform design verification. Design verification is performed in accordance with TFC-ENG-DESIGN-P-17 only. This guidance is not mandatory for all design reviews and may be modified, as needed, to meet specific applications.

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 effort to help ensure:

- Requirements are complete and sufficiently mature for the stage of the project
- Design outputs align with project input requirements (via the Design Requirements Compliance Matrix in accordance with TFC-ENG-DESIGN-C-42 (if available))
- Design optimization principals 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.

The review is intended to 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 perform reviews of portions of the design that have limited cost and complexity impact.

Another focus of the review is to evaluate the use of design optimization principles. The review should determine if 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. Team design reviews should be performed at each phase of design (e.g., 30%, 60%, 90%) as applicable. The design review for subsequent phases of design should consider comments from previous phases.

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

Responsibilities are contained within Section 4.0.

4.0 GUIDANCE

4.1 Design Review Scheduling

Project Manager/
Project Engineer

1. When a contract for Architect-Engineer (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 review milestones during the design agency kick-off and follow-on meetings in accordance with the guidance in Attachment B.

NOTE: Design review milestones should be selected based on scope, complexity, cost, and importance of the design. Three design milestones may not be appropriate for all designs.

3. Schedule for selected design reviews, preferably in the Integrated Mission Execution Schedule (IMES).

4.2 Preparation for Design Reviews

Responsible
Engineering Manager

1. Select a review Team Lead.

NOTE: Central Design Authority & Standards can be requested to supply and Engineering Discipline Lead as a Team Lead at the responsible Engineering managers’ request.

Review Team Lead

2. Select design review team members in conjunction with the project manager and project engineer. Identify the design review team members by name before convening the initial design review meeting.

The review team membership should include the following, as applicable. The team must include representatives of the organizations that are responsible for construction and operation of the SSC being designed, and a Nuclear Safety representative for any review of safety class or safety significant SSCs. Additional team members may include:

- Design customer/project manager
- Project engineer
- Engineering discipline lead
- Quality Assurance
- Nuclear Safety
- Operations
- Construction & Commissioning management
- Safety
- Environmental

- Personnel responsible for interfacing systems
- Testing
- Process engineer.

When a design has radiological impacts the review team shall include at least one individual who has been designated by the radiological engineer and who has completed the required qualifications:

- Non-Radiological Engineers - Course No. 350260, RPP Radiological Design Review Team Member.

When a design has fire protection impacts, the review team should include at least one individual who has completed, Course No. 350883, Fire Protection Engineer.

Project Manager/
Project Engineer

3. Appoint a secretary for the design review meeting. This can be any of the review team members or an independent person selected by the review Team Lead.
4. Develop a design review checklist with the review Team Lead. A graded approach should be used to determine the adequacy of the review, dependent upon the cost and complexity of the design. Use of a formal checklist is an INPO best management practice and should be developed specifically for the project.

NOTE 1: The checklists from TFC-ENG-DESIGN-P-17 may be used as a starting point as well as Design Requirements Compliance Matrices (DRCMs).

NOTE 2: Other checklist items may be applicable items from Attachment B, project specifications, engineering standards, etc. that address the purpose (see Section 1.0) of the design review.

Review Team Lead

5. Assemble a design review package including all applicable material needed to perform the review (e.g., Design Requirements Compliance Matrix (DRCM), review checklists, drawings, calculations, specifications, technical basis, previous design phase review reports, and other design documentation).
6. Provide the assembled review package to the review Team Lead.
7. Issue the design package to the review team members at least one week prior to the design review meeting (this can be accomplished in a preliminary review team meeting if desired).

NOTE: The package should include a list of specific assignments and required deliverables for each review team member and should include the project requirements matrix.

8. Prepare and communicate an agenda for the design review meeting to the respective design review team members.

9. Arrange the review meeting and room and schedule all review team members.

4.3 Conduct of Design Review

- | | |
|--------------------------------------|---|
| Review Team | <ol style="list-style-type: none"> 1. Review the design documents, including the DRCM if provided, prior to the design review meeting. 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. 2. Prepare comment sheets on the design documents prior to the meeting. Comments should either be documented directly on the review checklist, entered into a Review Comment Record (A-6005-747), or noted on the design media. 3. Forward the review comments to the review Team Lead at least two days before the scheduled review meeting. |
| Review Team Lead | <ol style="list-style-type: none"> 4. Consolidate the comments from the review team members.

NOTE: Should a review team member provide no response to the review Team Lead, then it may be assumed that the design review team member has no comments. This should be documented in the meeting minutes by the secretary. 5. Convene the design review meeting. |
| Project Manager/
Project Engineer | <ol style="list-style-type: none"> 6. 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).

NOTE: At the review Team Lead's discretion, this briefing may be done as the first step of the design review |
| Review Secretary | <ol style="list-style-type: none"> 7. Provide a synopsis of the results of reviews at earlier stages of the design, as applicable. Identify the status of any outstanding actions from prior reviews and the person(s) responsible for completion of the actions. |
| Review Team Lead | <ol style="list-style-type: none"> 8. Lead a discussion/resolution of the consolidated comments. If agreement on the resolution of any comments cannot be reached, assign actions, as needed, to ensure that the comments are satisfactorily resolved. |

- Review Secretary
9. Record the resolution of each comment on a consolidated Review Comment Record or the review checklist, as applicable.

NOTE: Comments made directly on the design media should be transferred to a Review Comment Record or review checklist as applicable.
 10. Take notes of any action items, including any unresolved comments, during the course of the meeting.
 11. Prepare meeting minutes after conclusion of the meeting.
- Review Team Lead
12. Schedule and ensure completion of any follow up actions.
 13. Prepare and issue the design review documentation in accordance with [TFC-ENG-DESIGN-C-25](#). Include the consolidated comment resolutions, meeting minutes, actions items, DRCM, and any other pertinent information that should be preserved to document the review.

5.0 DEFINITIONS

Design Agency/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
- Engineering Data Transmittal.

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

1. INPO 05-002, "Human Performance Tools for Engineers: Practices for Anticipating, Preventing, and Catching Engineering Errors," March 2005.
2. TFC-ENG-DESIGN-P-17, "Design Verification."
3. TFC-ENG-DESIGN-C-25, "Technical Document Control."
4. TFC-ENG-DESIGN-C-42, "Design Requirements Compliance Matrix."

ENGINEERING	Document	TFC-ENG-DESIGN-D-17.1, REV A-7
	Page	7 of 16
DESIGN REVIEW GUIDANCE	Issue Date	March 13, 2012

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 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. Discuss the Design Review Milestone Guidelines (Attachment B), the constructability review of design documents, and 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) Design Criteria Document and General Design Criteria or other level 2 spec or F&R document.
 - 4) Project (specific) Quality Assurance Plan (if applicable to A-E work) and NQA-1 Requirements.
 - 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.
 - 7) Estimating and Cost Control Manual for Construction Projects, or other appropriate guidance.
 - 8) Interface to Tank Farm Operating Contractor Computer-Aided Design System/electronic files.
- 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 A-E early in the project (within three to six weeks after the “kick-off” meeting) 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 dependant 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 REVIEW MILESTONE GUIDELINES

(Assuming Three Milestone Reviews)

Design Element	First Milestone Review (30%)	Second Milestone Review (60%)	Third Milestone Review (90%)
Process Engineering	<p>All process equipment identified and sized. Layouts and flow diagrams completed.</p> <p>Disposition of all effluents qualified.</p> <p>Materials of construction are specified.</p> <p>Safety systems identified.</p> <p>Deliverables for failure modes and effects analysis (FMEA).</p> <ol style="list-style-type: none"> FMEA at a systems level. Based on results of FMEA, list of systems requiring further Reliability and Maintainability analyses (RAM). Analysis (critical systems). RAM goals for critical systems. Material and energy balances. 	<p>First milestone review comments incorporated.</p> <p>All control parameters specified.</p> <p>Process equipment drawings and specifications 80% complete.</p> <p>All calculations complete.</p> <p>All safety systems components defined.</p> <p>Deliverables for FMEA:</p> <ol style="list-style-type: none"> Update RAM goals for critical systems. FMEA on critical systems to the subsystem level. Preliminary Authorization Basis (A/B) review. 	<p>All work complete and checked.</p> <p>Second milestone review comments incorporated.</p> <p>Deliverables for FMEA:</p> <ol style="list-style-type: none"> Update RAM goals for critical systems. FMEA on critical subsystems/components. Update A/B modification List of single failure points and rationale for why they are acceptable.
Architectural	<p>Plans – 60% complete except notes, dimensions, and sections.</p> <p>Sections – 60%</p> <p>Elevations – 60%</p> <p>Details – 40%</p> <p>Schedules – 60%</p> <p>Construction specifications – 30%</p>	<p>First milestone review comments incorporated.</p> <p>Plans – 80%</p> <p>Sections – 80%</p> <p>Elevations – 80%</p> <p>Details – 60%</p> <p>Schedules – 80%</p> <p>Construction specifications – 80%</p>	<p>All work complete and checked.</p> <p>Second milestone review comments incorporated.</p>

ATTACHMENT B – DESIGN REVIEW MILESTONE GUIDELINES (cont.)

(Assuming Three Milestone Reviews)

Design Element	First Milestone Review (30%)	Second Milestone Review (60%)	Third Milestone Review (90%)
Civil	Grading plan – 60% Site plan with utilities – 60% Typical road section. Calculations – 60% Construction specifications – 30%	First milestone review comments incorporated. Plans – 80% Sections and details – 70% Calculations – 80% Construction specifications – 80%	All work complete and checked. Second milestone review comments incorporated.
Structural	Calculations – 60% to match architectural progress. Drawings should show basic framing system, plan, sections, and some details.	First milestone review comments incorporated. Calculations substantially complete, including check.	All structural work complete. Second milestone review comments incorporated.
Environmental Control	Calculations – 60% Permitting strategies documented. Schematics showing major components; general arrangements; and flow diagrams of each system – 90%. Tabulation of major equipment detail: Equipment size – capacity, physical data, etc. Materials of construction. Functional requirements (temperatures, flows, etc.). Specify expected delivery period from placement of order on long lead, critical equipment. Detailed listing of drawings and specifications or data sheets.	First milestone review comments incorporated. Rough draft of equipment and construction specifications. Permitting strategies shared with the environmental enforcement agency and feed back is obtained. Plans – 80% Elevation – 80% Details – 60% Complete calculations. Completed schematics and engineering flow diagram. Physical arrangement on drawing complete (plan view). Control diagrams – 70% Demolition drawings – 80%	All work complete and checked. Second milestone review comments incorporated. Permitting strategies approved by the environmental enforcement agency. All disciplines cross-checked for interface (documented).

ATTACHMENT B – DESIGN REVIEW MILESTONE GUIDELINES (cont.)

(Assuming Three Milestone Reviews)

Design Element	First Milestone Review (30%)	Second Milestone Review (60%)	Third Milestone Review (90%)
Environmental Control (cont.)	Procurement/performance specifications – 30%	Procurement/performance specifications – 90%	
Piping	<p>Calculations -- 60%</p> <p>Schematics showing major components; general arrangements; and flow patterns of each system - 90%</p> <p>Brief tabulation of major equipment data:</p> <p>Equipment size – capacity, physical data, etc.</p> <p>Materials of construction.</p> <p>Brief functional requirements.</p> <p>Specify expected delivery period from placement of order.</p> <p>All data sheets and specifications for advance procurement complete.</p> <p>Procurement/performance and construction specifications – 30%</p>	<p>First milestone review comments incorporated.</p> <p>Rough draft of specifications. Pumps, compressor, etc. Electrical loads should be finalized.</p> <p>Plans – 80%</p> <p>Elevation – 60%</p> <p>Details – 60%</p> <p>Schedules – 80%</p> <p>Completed calculations updated.</p> <p>Completed schematics and engineering flow diagram.</p> <p>Physical arrangement on drawing complete (plan view).</p> <p>Identify work planned to complete drawings in tabular form.</p> <p>Control diagrams – 60%</p> <p>Procurement/performance and construction specifications - 90%</p> <p>Testing requirements – 90%</p>	<p>All work complete and checked, including cost estimating bills of material for CPAF work.</p> <p>Second milestone review comments incorporated</p>

ATTACHMENT B – DESIGN REVIEW MILESTONE GUIDELINES (cont.)

(Assuming Three Milestone Reviews)

Design Element	First Milestone Review (30%)	Second Milestone Review (60%)	Third Milestone Review (90%)
Electrical	<p>Initial start of one-line diagram, legend, notes.</p> <p>Complete floor plans showing preliminary layout of lighting and receptacles; location of major power distribution equipment such as switchgear, motor control centers, panelboards; location of major process equipment, motors, pumps, control panels, etc.; preliminary layout of telecommunications and alarm equipment such as PA system, fire alarm, intrusion alarm, telephone, computer outlets, etc. Outside distribution plans showing preliminary routing of utility services.</p> <p>Demolition sketches – 60%</p> <p>Electrical calculations.</p> <p>Procurement/performance and construction specifications – 30%</p>	<p>First milestone review comments incorporated.</p> <p>One-line diagrams – 90%</p> <p>Schematic and wiring diagrams – 60%</p> <p>Panel schedules and details – 60%</p> <p>Lighting and receptacles, controls and general details – 60%</p> <p>Final layout of electrical distribution system including all branch circuits, home runs, switchgear, and motor control center details – 60%</p> <p>Grounding plans and details – 60%</p> <p>Outside distribution plans – 90%</p> <p>Final layout of telecommunications and alarm equipment including tie-ins to existing circuits – 90%</p> <p>Electrical calculations – 90%</p> <p>Equipment specifications – 90%</p> <p>Electrical testing requirements – 90%</p> <p>Procurement/performance and construction specifications - 90%</p>	<p>All work complete and checked.</p> <p>Second milestone review comments incorporated</p>

ATTACHMENT B – DESIGN REVIEW MILESTONE GUIDELINES (cont.)

(Assuming Three Milestone Reviews)

Design Element	First Milestone Review (30%)	Second Milestone Review (60%)	Third Milestone Review (90%)
Instrumentation & Controls (e.g., Monitoring and Control Systems)	<p>Monitoring and Control System F&R Document – provides I&C, MCS baseline design requirements.</p> <p>Control system architecture, as required (defines control strategy, fully, semi, or automation or manual controls requirements, data communication protocols, and data storage and retrieval, HMI/PLC architectures).</p> <p>Instrumentation and control system diagram and tabulation.</p> <p>Software Quality Assurance Plan, as required.</p> <p>Control room layout and general instrumentation system field layout.</p> <p>Computer or data acquisitions specification draft. Design calculations.</p> <p>Procurement/performance and construction specifications – 30%</p>	<p>Control loop diagrams.</p> <p>Control and computer panel.</p> <p>Instrument specifications.</p> <p>Interconnections – tubing and cabling.</p> <p>Software requirements specification (computer and data acquisition specifications) as required.</p> <p>Software verification and validation test procedure, as required.</p> <p>Software I/O tag and address listing, as required.</p> <p>HMI interface screens, as required. Set points document, O&M manual.</p> <p>Interface subsystems procurement specifications.</p> <p>First milestone review comments incorporated.</p> <p>Procurement/performance and construction specifications – 90%</p> <p>I&C testing requirements – 90%</p>	<p>All work complete and checked.</p> <p>Second milestone review comments incorporated.</p> <p>HMI, PLC, communication, and data system software programming ready for initial testing, as required.</p> <p>Integrated testing (hardware, software, firmware, electrical wiring, sensors, interlocks, etc.), and software V&V report, as required.</p> <p>Software design descriptions, as required.</p>

ATTACHMENT B – DESIGN REVIEW MILESTONE GUIDELINES (cont.)

(Assuming Three Milestone Reviews)

Design Element	First Milestone Review (30%)	Second Milestone Review (60%)	Third Milestone Review (90%)
Mechanical	<p>Layout drawings – 60%</p> <p>Assembly drawings – 40%</p> <p>Detail drawings – 20%</p> <p>Calculations – 40%</p> <p>Tabulation of equipment, material, services – 60%</p> <p>Identification of long-lead procurement items.</p> <p>Construction specifications – 30%</p>	<p>First milestone review comments incorporated.</p> <p>Layouts complete.</p> <p>Assemblies – 60%</p> <p>Details – 40%</p> <p>Calculations – 80%</p> <p>Inst. drawings – 30%</p> <p>Tabulations of equipment, material, services.</p> <p>Identify work and schedule to complete drawings.</p> <p>Construction specifications – 90%</p> <p>Mechanical testing requirements – 70%</p>	<p>All work completed and checked.</p> <p>Second milestone review comments incorporated.</p>
Cost Estimating	<p>Work breakdown structure (WBS) complete.</p> <p>Basis for cost estimate complete.</p> <p>Project construction work plan by participant complete.</p> <p>Project schedule for design, equipment, procurement, and construction work complete and in usable detail.</p> <p>Construction craft and crew rates complete.</p> <p>Miscellaneous costs, indirect costs, job factors, construction support activity, and other factors that have a cost impact on project construction work are 95% complete.</p>	<p>First milestone review comments incorporated.</p> <p>Miscellaneous cost determinators complete.</p> <p>Cost code system complete.</p> <p>Architectural, structural, and civil cost estimate complete.</p> <p>Electrical, instrumentation, piping, and environmental</p> <p>Control cost estimates 90% complete.</p> <p>Deviations from budget estimate identified and rationalized.</p> <p>All unit prices established.</p>	

ATTACHMENT B – DESIGN REVIEW MILESTONE GUIDELINES (cont.)

(Assuming Three Milestone Reviews)

Design Element	First Milestone Review (30%)	Second Milestone Review (60%)	Third Milestone Review (90%)
Cost Estimating (cont.)	<p>Determine contingency and escalation, if any, to be applied.</p> <p>Determine base cost data.</p> <p>Cost Code System 95% complete.</p> <p>Architectural, structural, and civil cost estimate in proper form and 95% complete.</p> <p>Electrical, instrumentation, piping, and environmental control bills of material up-to-date with design status and priced out in proper form.</p> <p>Computerization of cost estimate, when required, up-to-date with current status of design engineering.</p> <p>Title I cost estimate complete.</p>		<p>Title II cost estimate in final form with only minor items needed to complete.</p> <p>Second milestone review comments incorporated</p>
Construction	<p>Conduct a documented site walk down to confirm current status, if required.</p>	<p>First milestone review comments incorporated.</p> <p>Review for safety or operating hazards involving construction.</p> <p>Review for construction methods, construction economics, and accessibility.</p> <p>Review feasibility of recommended work assignment (CMP) or fixed-price contract and special equipment procurement by WRPS.</p>	<p>Review for safety, etc. (see item under 60% reviews).</p> <p>Second milestone review comments incorporated</p> <p>Completeness of total design as needed for contracting purposes.</p> <p>Review for errors, ambiguities, omissions, clarity, and interferences.</p> <p>Review for operational phase (ensure that work specified will provide minimum interferences and conflicts with operating group during construction).</p>

ATTACHMENT B – DESIGN REVIEW MILESTONE GUIDELINES (cont.)

(Assuming Three Milestone Reviews)

Design Element	First Milestone Review (30%)	Second Milestone Review (60%)	Third Milestone Review (90%)
Construction (cont.)			<p>Review construction methods, openings sized appropriately for access, etc., for adequacy and practicability.</p> <p>Review for start of preparation of special conditions and review procurement plans.</p> <p>Review definitions of and availability of government-furnished items (also provide for proper identification, storage, and release to contractor in an orderly manner).</p> <p>Review for storage facilities, rest rooms, security boundaries, temporary electrical, utility services, and parking as related directly to the contractor's activities.</p>
Operations	Operational concept agreed to and checked against the P&IDs	<p>First milestone review comments incorporated.</p> <p>Operational and maintenance concepts final.</p> <p>Maintenance procedures identified and Preventive Maintenance Identification (PM Id) Forms generated – 60%</p> <p>Operating procedures – 60%</p>	<p>All vendor information required for operations is identified and presented.</p> <p>Second milestone review comments incorporated.</p> <p>Maintenance procedures and PM Id Forms completed.</p> <p>Operating procedures completed.</p>