



SUBJECT: DESIGN REVIEWS

1.0 PURPOSE

1.1 This EOP defines responsibilities and procedural requirements for conducting design reviews.

2.0 GENERAL APPLICATION

2.1 Design reviews are formal, design adequacy evaluations which are performed by knowledgeable persons other than those directly responsible and accountable for the design.

2.2 The Responsible Manager decides when Design Reviews are required, then assures that they are conducted per this EOP.

2.3 Design reviews are generally used to evaluate any of the following for adequacy;

- product designs and accompanying documentation,
- design processes,
- design methods,
- analytical models,
- design criteria,
- materials applications,
- development programs,
- computer programs (e.g., those covered by EOP 40-3.00).

2.4 When appropriate, design reviews may be used to verify that product designs meet functional, contractual, safety, regulatory, industry codes and standards, and Company requirements.

2.5 When a design review is performed for independent design verification, EOP 42-6.00 also applies.

2.6 When an engineering test at an operating plant is to be design reviewed, EOP 35-3.10 also applies.

2.7 Design Reviews are defined to be "Open" until the Design Review Report and all action items have been completed and documented per this EOP.

+ General Revision

Date Issued	Revision	Supersedes	Page
March 29, 1991	7	Rev. 6 (5/1/90)	1 of 18

- 2.8 Design Review status is tracked and reported per this EOP.
- 2.9 Supplement A contains instructions for completing the Design Review Notification form SD-003. Alternatively, an equivalent letter format with at least the same information may be used.
- 2.10 Appendix A contains Design Review Guidelines.
- 2.11 Appendix B contains factors for Design Review Consideration.
- 2.12 Appendix C contains a sample Design Review Closure letter.
- 3.0 DEFINITION OF RESPONSIBLE INDIVIDUAL OR ORGANIZATION
- 3.1 The following defines the responsible individual or organization for activities established in Section 4.0 of this EOP.

Configuration Management - Component responsible for: issue and control of assigned releases; providing inputs to schedule engineering tasks; distribution of engineering documents; and retention and control of document masters.

Design Representative - The individual directly responsible for the design or scope to be reviewed (Responsible Engineer as defined in EOP 42-6.00 for design verification application).

Responsible Manager - Manager having overall responsibility for design or scope to be reviewed.

Review Chairperson - An individual not directly responsible for the design being reviewed (Verifier as defined in EOP 42-6.00 for design verification application).

4.0 PROCEDURE AND RESPONSIBILITIES

4.1 Responsible Manager

4.1.1 Initiate design reviews as follows:

- a. Identify or concur with the need for a design review, and the review scope.
- b. Assign the Design Representative and select a Review Chairperson.

- 4.1.2 Approve the Design Review Notification before the design review is conducted.
- 4.1.3 Assure that any issues within the review scope are resolved and documented before closing the Design Review.
- 4.1.4 Approve the Design Review Report if required (see 4.3.4.h).
- 4.1.5 Certify the Design Review is closed by approving the Design Review Closure letter (Appendix C or equivalent) when all required actions are completed.

Note: While the Design Review Report may be issued with committed actions, the Design Review is considered "open" until all committed actions are completed.

Exception: Design reviews conducted to meet the requirements of EOP 40-3.00, Engineering Computer Programs, do not require this separate certification.

- 4.1.6 Assure that any issues involving matters outside the design review's scope are appropriately addressed.

4.2 Design Representative

- 4.2.1 Prepare for design reviews as follows:

- a. Obtain a Design Review DRF number from Configuration Management per EOP 42-10.00.

Exception: Design Reviews conducted to meet the requirements of EOP 40-3.00 do not require a separate Design Review DRF number.

- b. Define the design review scope and purpose and obtain agreement from the Review Chairperson. See Appendix B for factors to consider.
- c. Identify the design team.
- d. Assist the Review Chairperson with selecting the review team.
- e. Prepare the Design Review Notification per Supplement A covering the following:
 - (1) Design team

- (2) Design review team
 - (3) Design review purpose, scope and schedule
- f. Obtain the Responsible Manager's approval.
- g. Assemble and provide pre-review data and supplemental information to the review team.
- h. Distribute the Design Review Notification to the following:
 - (1) Review Participants
 - (2) Responsible Management
 - (3) Responsible Program Manager(s)
 - (4) Lead System Engineer(s), if applicable
 - (5) Others, as appropriate
- 4.2.2 Prepare presentations and participate in the design review meeting(s).
- 4.2.3 Support design review closure as follows:
 - a. Identify/determine action items to resolve each design review finding, or document actions completed.
 - b. Assure that each action item commitment has 1) a specific description, 2) the person responsible for its completion, and 3) a scheduled completion date.
 - c. Transmit the action items to the Review Chairperson.
 - d. Resolve disagreements between the Review Chairperson and the design team regarding action item adequacy. If necessary, escalate through successive management levels until resolution is reached.
 - e. Assure that action items not closed in the Design Review Report are either included on a work authorization, or submit them to Configuration Management for scheduling per EOP 25-5.00.
 - f. Obtain the Responsible Manager's approval if required (see 4.3.4.h).

- g. Sign the Design Review Report and place a copy of it and any supporting documentation in the applicable DRF.

Note: The Design Review Report may be placed in the Design Review DRF or in another related DRF.

- h. Complete all action items committed in the Design Review Report.
- i. Document action item completions and file them in the applicable DRF. Reference supporting DRFs as needed.
- j. Document Design Review closure by preparing a Design Review Closure letter per Appendix C, or equivalent, and filing it in the Design Review DRF. Reference the letter and its location on the DRF index sheet. (See Paragraph 4.1.5 "Note" and "Exception".)
- k. Close the Design Review by submitting the Design Review DRF to Configuration Management for microfilming and closure per EOP 42-10.00. If it is necessary to submit the DRF for microfilming prior to completion of all actions for Design Review Closure, obtain a supplemental Design Review DRF number and reference it in the original DRF.

Exception: Design reviews conducted to meet the requirements of EOP 40-3.00 are closed by completing the action required by that EOP.

4.3 Review Chairperson

4.3.1 Prepare for the design review as follows:

- a. Agree to chair the design review.
- b. Concur with the design review scope and purpose, or negotiate changes as needed.
- c. Select the review team with the Design Representative's assistance.
- d. Obtain any required pre-review data and background information from the Design Representative.

4.3.2 Conduct the design review meeting(s). See Appendix B for factors that should be considered.

- 4.3.3 Document design review findings and committed or completed actions as follows:
- a. Working with the review team, identify the findings to be resolved and inform the Design Representative. The findings may take the following forms:
 - (1) Specific action(s) that when completed will produce a design that is adequate.
 - (2) An issue(s) that needs further investigation followed by another design review meeting.
 - (3) An issue(s) that must be investigated and resolved by the design team. Conclusions or implementation actions, along with reasons, must be documented in the applicable DRF.
 - b. Review with the review team the actions to resolve findings proposed by the Design Representative.
 - c. Assure that any issues between the design team and the review team regarding actions required to resolve findings are closed before issuing the report. Escalate as needed.
- 4.3.4 Prepare the Design Review Report which includes, but is not limited to, the following: (Confine to the scope reviewed. Refer to Appendix A, Paragraphs A8, A9, and A10.)
- a. Applicable DRF number.
 - b. Subject.
 - c. Date the review was held.
 - d. Scope.
 - e. Participants.
 - f. Specific statement of Review Team conclusions regarding design adequacy.
 - g. Summary of the review, the review results, and the basis for conclusions.
 - h. Review Team findings and Design Team committed and completed action items.

- (1) For Design Reviews conducted for design verification per EOP 42-6.00, assure that: the review team's findings are resolved and the completed actions are documented in the report, a verification statement is included, and the report is signed by the Review Chairperson and Design Representative. Responsible Manager approval shall be obtained as required by EOP 42-6.00.

If the design review findings cannot be resolved in a timely manner, defer the verification per EOP 42-6.00 and proceed per Paragraph 4.3.4h(2).

- (2) For Design Reviews conducted for reasons other than design verification, assure that: the review team's findings are resolved either by completed actions documented in the report or by open action items documented in the report, any action item commitments have been scheduled, and the report is signed by the Review Chairperson, Design Representative and, if there are open action items, the Responsible Manager.

- j. References to DRFs which contain information supporting the review's conclusions. (This is required only when the supporting information is not included in the report.)

4.3.5 Distribute the final Design Review Report to the same distribution as the Design Review Notification.

4.3.6 Assure that any issues involving matters outside the design review's scope are documented to the Responsible Manager.

4.4 Configuration Management

4.4.1 Provide Design Review DRF numbers upon request.

4.4.2 Control Design Review DRF numbers in the same manner as other DRF numbers, but with a numbering system that allows Design Review DRF numbers to be distinguished from other DRF numbers.

4.4.3 Enter Design Review DRF numbers into the scheduling system per EOP 25-5.00 when the numbers are issued.

4.4.4 Enter design review report action item commitments into the scheduling system per EOP 25-5.00 based on input from the Design Representative.

4.4.5 Assure that Design Review DRFs submitted for closure contain a Design Review Closure letter containing at least the information in Appendix C, and are approved by the Responsible Manager, before closure per EOP 42-10.00, or that a supplemental Design Review DRF number is referenced in the submitted DRF.

4.4.6 Close out Design Review DRFs in the scheduling system per EOP 42-10.00 when requirements of Paragraph 4.4.5 have been met.

4.4.7 Report Design Review status periodically.

5.0 RESPONSIBILITY FOR COUNSELING

For counsel on matters pertaining to this EOP, refer to the EOP Counsel Matrix in EOP 15-1.00.

6.0 REFERENCES

EOP 25-5.00	Planning and Scheduling
EOP 35-3.10	Special Engineering Tests/Inspections at Operating Plants
EOP 40-3.00	Engineering Computer Programs
EOP 42-6.00	Independent Design Verification
EOP 42-10.00	Design Record Files

APPENDIX A

GUIDELINES FOR DESIGN REVIEWS

A1 Introduction

- A1.1 This appendix is intended to provide guidance for using the design review process more effectively. Its contents are not requirements, but should be considered when preparing for, conducting, or reporting Design Reviews.

A2 Design Review Objective

- A2.1 A Design Review's objective is to produce improved technical and business results for both customers and GE by helping to assure requirements are met while concurrently raising quality, and reducing cost and risk.

A3 Strategy

- A3.1 The basic strategy is to bring more GE and, where appropriate, customer resources to bear on design issues and problems. New perspectives can be provided by qualified technical people who are independent from the design. Synergy between the design and review teams may produce ideas, alternatives and perspectives which would not have developed otherwise.

A4 Identifying the need for a Design Review

- A4.1 Design solutions, issues, or problems should be reviewed any time the situation is not a straight forward application of a previous design, and particularly where there has been difficulty establishing the design requirements or details.
- A4.2 In addition, design reviews are appropriate in cases where there is high technical risk, regulatory sensitivity, and/or financial impact. The principal factors which influence this judgment are:
- a. Significant departures from proven designs
 - b. Significantly different applications for a known design
 - c. New technology
 - d. Significantly reduced margins
 - e. Several engineering disciplines are involved
 - f. Complex interfaces with other design areas
 - g. Regulatory requirements for design verification
 - h. High implementation costs

- i. Long term or large resource commitment
- j. Large Warranty or liability risk

A5 Timing of Design Reviews

A5.1 To be effective, reviews must be held when there is still enough time, either calendar or contractual, to implement the review's results.

A5.2 Most Design Reviews will fall into the following general categories. Any one or more may be appropriate.

- a. Conceptual - Generally held prior to finalizing the proposal. Assures that the design specifications meet the requirements, and that the design concept will fulfill the requirements in the best way known.
- b. Intermediate - Held early in the design phase when layouts, schematics, etc., are available. Assures the design approach and plan remains consistent with the requirements. Reviews analysis and early test results, margins, material applications, etc.
- c. Design Release - Confirms overall readiness prior to release for manufacturing, procurement, or use at an operating plant. Reviews all technical disciplines, final analysis results, and any available prototype test results.
- d. Design Problem - Reviews problems with design in test or service, and proposes solutions.

A6 Preparing for Design Reviews

A6.1 Design review value is directly related to preparation quality.

A6.2 One element of a successful review is the scope statement clarity. If the review team does not know what the question is, they may answer some other question.

A6.3 Another important preparation item is selecting the chairperson. The chairperson should be a technically qualified individual who is independent of the design to be reviewed, and is proficient at conducting reviews.

- A6.4 The review team selection depends on the review subject and type. The team's technical competence should apply to the design scope and fall into three broad categories:
- a. Broad design experience on similar designs,
 - b. Specialized technical expertise such as in heat transfer, materials, structural analysis, etc., and
 - c. Functional expertise such as manufacturing engineering, customer service, legal, etc.

A7 Conducting Design Reviews

- A7.1 To realize full benefit, design review meetings must primarily focus on the specific design review scope, but some time must be allowed to explore related issues to identify possible risk areas not addressed in the review scope.
- A7.2 The Review Chairperson should have a structured agenda with a purpose for each agenda item.
- A7.3 "Outside of Scope" statements can be used to focus discussion, but must not be used to ignore significant issues.
- A7.4 Issues which are "Outside of Scope" usually do not need to be resolved during the review. They do need to be clearly documented and transmitted to the responsible manager for resolution.

A8 Reporting Design Review Results

To be effective, Design Review results must be documented using clear, concise, and factual language with nothing left open. Refer to Paragraph A10. A suggested report format follows:

- a. Design Review DRF number
This identifies the Design Review DRF.
- b. Subject
This identifies the design that was reviewed.
- c. Date the review was held.
- d. Scope

This is a clear, concise, accurate scope description. Scope inclusions and exclusions should be emphasized.

e. Participants

This is a listing of the participants' names, along with their organizational affiliation and position on the team.

f. Conclusion

State the conclusions with the following specific statements:

1. The design is adequate/inadequate/conditionally adequate. Refer to the definitions in Paragraph A9.
2. Actions required to resolve findings have either been completed, with documentation included in the report, or are committed with schedules.

g. Summary

Include a review summary containing the general basis for the design review's conclusion.

h. Review Team findings

Review team findings are listed here.

Refer to Paragraph 3.3.3 for definitions.

i. Action Items

Action items required to resolve Review Team findings are listed here. Each action item committed during the review is listed with the action item description, the responsible person, component, and the completion schedule.

Actions completed prior to issuing the Design Review Report should be included here along with an associated completion statement.

j. DRF Reference

Information which is supplemental to the report and is required to support the report's conclusions should be listed here. Identify the DRF(s) where the supplemental information is located (Design Review DRF or others).

In addition, identify the DRF where the Design Review Action Item closure documentation will be filed. This should normally be the Design Review DRF or supplement.

A9 Adequacy Definitions

A9.1 Generally, the design review objective is to find the design adequate or inadequate, not to find improvements to an already adequate design.

a. Adequate Design

A design is judged to be adequate when at least the following criteria have been met:

- (1) It is complete and final, and
- (2) The design meets its requirements and therefore will perform its intended function, including safety, reliability, operability, maintainability, licensability, interface compatibility, etc., considerations, and
- (3) There are no findings, or
- (4) Actions taken to resolve findings have been completed.

Note: Designs which are incomplete can only be found "conditionally adequate" even though the only action may be to complete the design per the applicable requirements.

b. Conditionally Adequate Design

The design is currently inadequate but the review team finds that it can be made adequate by completing and documenting certain actions.

c. Inadequate Design

The design is inadequate when the review team believes, from the information presented, that the design does not meet its requirements and therefore will not perform its intended function. This conclusion will be reached when actions are extensive, complex, or cannot be readily determined.

A10 Design Review Report Style Guide

- A10.1 Reports use factual, clear, and concise language. Authors state only facts known, and conclusions made, by the design review team relative to the adequacy of the design being reviewed.
- A10.2 Authors do not speculate. If there is a need for further information, technical work and/or justification to establish the design's adequacy, these needs are stated as findings with respect to the requirements, and resolved by documented actions to be taken by the design team. If the review team has questions regarding the adequacy of any test, analysis, etc., these questions too are resolved by documented actions to be taken by the design team.
- A10.3 Report only facts covered in the design review or personally known by the reviewers. Design Review Team beliefs that other information applicable to the design review subject is available should be documented as findings. These findings are resolved by documented actions to be taken by the design team to identify and provide this information. The Design Review team evaluates this information prior to reaching a design adequacy conclusion.
- A10.4 Any applicable historical information must be included in context. Questions regarding whether current and previous conclusions are consistent should be documented as findings. These questions must be resolved by documented actions to be taken by the design team to reconcile the current and previous work.
- A10.5 Conclusions are specific and unambiguous. Document the basis for any conclusions that require subtle or complex interpretation of the facts presented. Include, at least by reference, any additional information used as a basis for conclusions. Avoid generalizations and sweeping conclusions. These lead to ambiguity regarding the actual review team conclusions.
- A10.6 State conclusions and actions as "positive" statements of either what was done or what is required. Statements regarding what was not done leave ambiguity regarding the need for additional action. Statements regarding such things as "responsibility for" are ambiguous as to whether the responsibility was actually exercised, and therefore leave uncertainty as to whether there is some remaining technical doubt.

APPENDIX B

FACTORS FOR DESIGN REVIEW CONSIDERATION

B1 Introduction

- B1.1 This appendix is intended to provide guidance for using the design review process more effectively. Its contents are not requirements, but should be considered when preparing for, conducting, or reporting Design Reviews.
- B1.2 The following factors should be considered first to determine the appropriate review level and scope, and second as potential questions for the review team.

B2 Product Requirements

- a. Is a new function or major new feature required?
- b. Are design margins significantly affected?
- c. Have customer requirements tightened, e.g. accuracy, warranty, efficiency, etc.?
- d. Have the requirements for safety, reliability, durability, availability, environmental compatibility, etc., been changed?

B3 Interfaces

- a. Have all interfaces been identified (electrical, mechanical, user, maintenance, etc.)?
- b. Is interface compatibility affected?
- c. Does the design have to replace an existing design?
- d. Has the design process provided for confirmation of interface compatibility?
- e. Is field action required to confirm interface compatibility?

B4 Product/Process Technology

- a. Has the design team had adequate experience with the technology?
Is a new technology involved?

- b. Will a new material be used for a critical function?
- c. Are new manufacturing processes or advanced production techniques required?
- d. Are design parameters being extrapolated significantly beyond known values?

B5 Application Environment

- a. Is the design to be used in an environment within which the design team has little experience?
- b. Are new/changed skill levels required for people using the design.

B6 Regulatory and Liability Exposure

- a. Is the design subject to regulations, codes, and standards with which the design team has little experience?
- b. Is the product subject to new flammability, toxicity, electromagnetic radiation, noise, etc., requirements?
- c. Have significant design or manufacturing responsibilities been subcontracted to new vendors?
- d. Will different organizations be involved?
- e. Will the division of responsibility be changed?
- f. Have the specifications on a traditional vendor been significantly changed?
- g. Have significant components or subassemblies been shifted from make to buy or buy to make?

B7 Schedule and Resources

- a. Are steps planned in parallel when they would normally be done in series?
- b. Do the design team's combined skills really cover the technologies required?

B8

Ability to Test

- a. Is it technically feasible to conduct thorough design qualification tests before release?

SAMPLE

Design Review DRF Number: _____

Supporting information for this Design Review is also contained in DRFs _____, if applicable.

Responsible Manager Sign _____ Date _____
Print _____