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Plant Support Engineering: Guidelines for Optimizing the Engineering Change Process for Nuclear Power Plants, Revision 2

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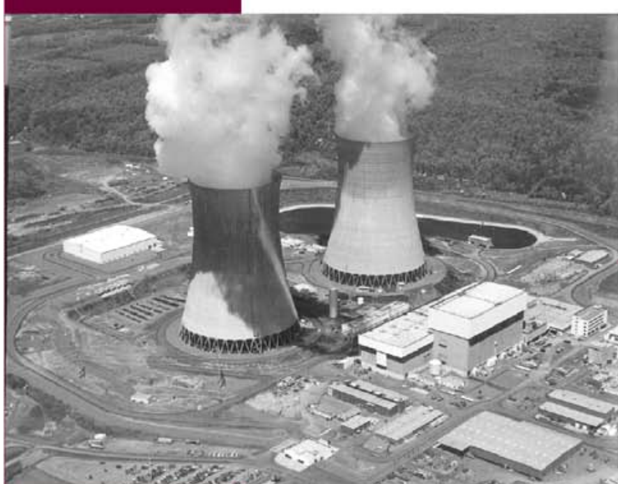

Engineering Support

Reduced Cost

Technical Excellence

Plant Support Engineering: Guidelines for Optimizing the Engineering Change Process for Nuclear Power Plants, Revision 2

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Final Report, November 2007

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PRODUCT DESCRIPTION

This report supersedes EPRI report TR-103586-R1 in its entirety.

The objective of this report is to present decision criteria that licensees can apply to select the level of administrative and technical effort appropriate for any given engineering change—whether it is a large, complex change with safety significance, a small insignificant change, or a documentation change with no impact on safety. The change must be categorized correctly, the regulatory requirements properly considered, and the appropriate level of review applied. This report provides guidance in these areas, and it is structured so that any licensee can use its recommendations without making wholesale changes to their respective engineering change program.

Results and Findings

This guideline provides the following:

- Updated flowcharts demonstrating a recommended engineering change process that can be used to benchmark a licensee's process, highlighting areas of potential improvement
- Analysis of the current regulatory requirements for each type of change, discriminating between perceived and real requirements
- Decision criteria used to develop a given change's administrative, engineering, and safety requirements
- Revised recommendations identifying ways that licensees can alter processes to reduce engineering and operations efforts
- Additional examples of how the recommended process can be implemented

Challenges and Objectives

Since the issuance of the original and Revision 1 of EPRI report TR-103586, *Guidelines for Optimizing the Engineering Change Process for Nuclear Power Plants*, a great deal of effort has been expended by the Nuclear Regulatory Commission (NRC) and the industry to develop improved guidance on the implementation of 10CFR50.59. The NRC amended its regulation concerning changes, tests, and experiments at nuclear power plants on October 4, 1999 (64 FR 53582). The Nuclear Energy Institute (NEI) continued its 96-07 Initiative with *Guidelines for 10CFR50.59 Implementation* (NEI 96-07 Revision 1), which was published in November of 2000. NEI 96-07 is based on guidance previously developed by EPRI and reported in EPRI report NSAC-125, *Guidelines for 10CFR50.59 Safety Evaluations*, modified to address

NRC comments and concerns. The NRC published Regulatory Guide 1.187, *Guidance for Implementation of 10CFR50.59, Changes, Tests and Experiments*, with an effective date of March 13, 2001, which endorsed NEI 96-07 Revision 1 as providing methods acceptable to the NRC staff for complying with the provisions of 10CFR50.59.

Following the publication of NEI 96-07 Revision 1 in November 2000, Plant Support Engineering (PSE) member utilities requested clarification to address inconsistencies between the guidance presented in EPRI report TR-103586-R1 and the revised guidance in NEI 96-07 Revision 1.

Applications, Value, and Use

Implementation of engineering changes is a significant cost element in nuclear power plants. This report provides an engineering change process that can reduce engineering and operating costs by eliminating redundant and unnecessary efforts.

EPRI Perspective

Optimizing the engineering change process can reduce the average cost, cycle time, and resources needed for implementing plant changes. Implementation of the guidance in this report is unique to each utility, depending on the content of the current change process, organizational structure, and utility culture. This report focuses primarily on the design phase of the engineering change process. However, it also addresses the interface between design and other implementation activities. It does not address the details of installation, post-installation testing, turnover after the design phase, or temporary changes that are implemented on an interim basis to specific utility program requirements. Related EPRI reports include NP-3434, *Value-Impact Analysis of Selected Safety Modifications to Nuclear Power Plants*; NP-5640, *Nuclear Plant Modifications and Design Control: Guidelines for Generic Problem Prevention*; and NSAC-105, *Guidelines for Design and Procedure Changes in Nuclear Power Plants*.

Approach

Like the original report and the first revision, the development of this revision began by forming a PSE task group composed of interested utility personnel and industry consultants. Task group members contributed information and examples to provide guidance on optimizing the engineering change process, as well as lessons learned and implementation best practices. Task group members debated, compiled, and reviewed all information resulting in this second revision to EPRI report TR-103586-R1.

Keywords

Plant support engineering
Assessment and optimization
Licensing and safety assessment
10CFR50.59

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ADDENDUM

The following cautions apply concerning the use of equivalency evaluations as a mechanism for performing 10CR50.59 screening as noted on pages 3-15; Section 3.10; 4th bullet, page 3-18; Note 3, and page 4-9; Note (1).

When a licensee's equivalency evaluation is used as an alternate screening tool, (1) The individuals performing the screening should receive training on 10CFR50.59 that is equivalent to the training received by individuals who perform 10CFR50.59 screening, and (2) The equivalency process should include a focus on determining that the equivalency (that is, change) does not adversely effect design functions.

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1 INTRODUCTION

1.1 Issue

In 1993, EPRI Plant Support Engineering (PSE) initiated a utility task group to evaluate engineering change control practices at nuclear utilities and prepare a report recommending ways in which such practices might be improved. At many utilities, the design change process in place remained identical to that in use at the time of initial plant operation. These processes were characterized by a one-size-fits-all structure, with extensive reviews and approvals required for all changes, regardless of the scope or magnitude. The concern of PSE member utilities was that these inefficient engineering change practices were resulting in unnecessarily high costs to implement plant design changes.

The Engineering Change Optimization (ECO) task group met several times throughout 1993 and developed guidelines for improving the efficiency of the engineering change process while maintaining compliance with regulatory requirements. These guidelines were published in March of 1994 as EPRI report TR-103586, *Guidelines for Optimizing the Engineering Change Process for Nuclear Power Plants*. Many utilities have implemented portions or all of the recommendations included in TR-103586, with resultant increases in the efficiency of their engineering change processes.

Between 1994 and 1998, several developments resulted in PSE member utilities requesting a review of TR-103586 and the subsequent issuance of supplemental guidance (EPRI report TR-103586-R1, *Guidelines for Optimizing the Engineering Change Process for Nuclear Power Plants: October 1998 Revision*). These developments included the following:

- Increased regulatory scrutiny on the processes used by utilities to meet the requirements of 10CFR50.59, as demonstrated in numerous inspection activities undertaken by the NRC
- Publication of significant new guidance by NEI on the performance of 10CFR50.59 screens and evaluations required
- Increased regulatory scrutiny on utility efforts to maintain consistency between the UFSAR and design basis documents and to ensure that all changes impacting the UFSAR descriptions are properly reflected in UFSAR updates
- Clarification needed on the relationship between the guidance contained in EPRI report NP-6406, *Technical Evaluation of Replacement Items in Nuclear Power Plants,* and TR-103586, as it related to performance of equivalency evaluations
- A desire to incorporate experience from implementation of the recommendations of TR-103586, which can now be fed back into the process as lessons learned

- Additional guidance on ways to further optimize the engineering change process to achieve additional cost savings while maintaining compliance with regulatory requirements

In November 2000, NEI issued revised guidance on 10CFR50.59 implementation in response to the 1999 revision of 10CFR50.59. This guidance was subsequently endorsed via Regulatory Guide 1.187.

Following NRC endorsement of NEI96-07, Revision 1, Guidelines for 10CFR50.59 Implementation, PSE member utilities requested a review of EPRI report TR-103586-R1 to identify any inconsistencies between the EPRI guidance and the revised NEI guidance endorsed by Regulatory Guide 1.187. Inconsistencies identified during the review have been addressed in the revised guidance contained in this report.

1.2 Purpose

The purpose of this guideline is to present decision criteria that utilities can apply to select the level of administrative and technical effort appropriate for any given engineering change—whether it is a large, complex change with safety significance, a small insignificant plant change, or a documentation change with no impact on safety. The change must be categorized correctly, the regulatory requirements properly considered, and the appropriate level of review applied. This document provides guidance in these areas, and it is structured so that any utility can use its recommendations without making wholesale changes to their existing engineering change program. The guideline addresses the following specific issues that utilities indicate are significant:

- The need to distinguish the level of detail, effort, and review required for a given engineering change based on its safety significance, cost, and complexity
- The need to distinguish between real requirements and those that have entered utility programs because of perception or historical events, such as one-time regulatory findings
- The need for a more structured, better-organized process that eliminates redundant or unnecessary efforts
- The need for engineering personnel to make decisions on the level of effort and review required to implement engineering changes using effective decision-making criteria on a change-specific basis

1.3 Methodology

The methodology used to prepare this revision to EPRI report TR-103586 is as follows:

- A working group of approximately 15 utility and nuclear industry personnel was formed specifically to address inconsistencies between the guidance in EPRI report TR-103586-R1 and NEI 96-07 Revision 1 relative to equivalent changes. Participation on the working group was targeted to include representatives from the NEI 96-07 Task Force as well as representatives from the previous Engineering Change Optimization Task Group.

- The working group conducted a review of the requirements in NEI 96-07 (as endorsed by Regulatory Guide 1.187) as compared to the guidance in EPRI report TR-103586-R1 and recommended changes to the guidance to ensure that it was consistent with NEI 96-07 Revision 1.
- This report documents the results of the working group.

1.4 Scope

This guideline focuses primarily on the design phase of the engineering change process, which initiates after a decision has been made that a change is needed. Because of its impact on the development of an engineering change, the guideline addresses key aspects of the closeout process. It does not address the details of installation, post-installation testing, and turnover after the design phase. It addresses only the interface between design and these other implementing activities.

For the purposes of this guideline, the scope is limited to permanent engineering changes and does not directly address temporary engineering changes (that is, temporary modifications or temporary alterations). The guidance provided in this report as well as in INPO guidelines might be applicable when performing temporary changes. Temporary changes are recommended only to alleviate an unsafe condition, to perform a test or experiment, or to alleviate a degraded or nonconforming condition. Temporary modifications are not recommended for the convenience of engineering, maintenance, or plant operations personnel.

This guideline provides the following:

- Flowcharts demonstrating a recommended engineering change process that can be used to benchmark a utility’s process, highlighting areas of potential improvement
- Analysis of the current regulatory requirements for each type of change, discriminating between perceived and real requirements
- Decision criteria used to develop a given change’s administrative, engineering, and safety requirements
- Recommendations identifying ways utilities can alter processes to reduce engineering and operations efforts
- Examples of how the recommended process can be implemented

Implementation of the guideline is somewhat unique to each utility, depending on the condition of the current change process, organizational structure, and utility culture. These issues are not addressed in the guideline.

The guideline is organized in the way it was developed. First, key definitions were developed to ensure a common understanding of terms used in the guideline. They are included in Section 2. Next, the current regulatory requirements were defined and distinguished from nonregulatory actions and other good practices. This area is addressed in Section 3. Simplified process flowcharts for a hierarchy of engineering changes were then developed with screening criteria that guide the technical and administrative contents of any particular change package. This area is addressed in Section 4. Within Section 4, specific recommendations are highlighted in boxed areas after each subsection to maintain continuity and to focus on recommendations specific to the topic. Section 5 addresses additional training that might be needed to implement the guideline recommendations effectively. Finally, Section 6 describes how improvements to the engineering change process can be measured through a number of performance indicators. The appendices contain examples that illustrate how the process can be implemented.

2
DEFINITIONS

2.1 Basic Premises and Key Definitions

2.1.1 Hierarchy of Requirements

Figure 2-1 illustrates a hierarchy of requirements affecting the design of structures, systems, and components (SSCs) typical for any operating nuclear power plant. The pyramid shape represents the relative numbers of requirements that are managed and maintained throughout the life of the plant.

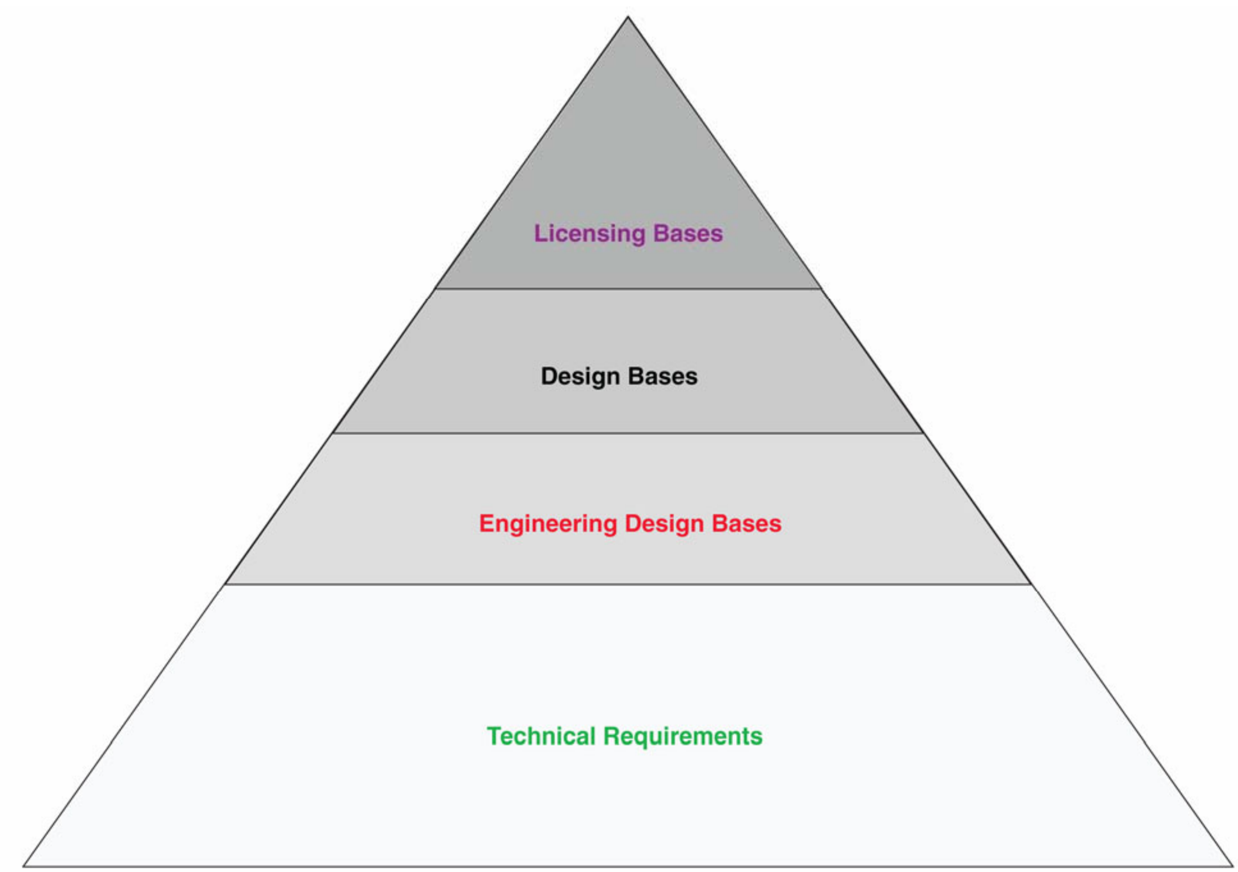


Figure 2-1
Hierarchy of Requirements Affecting Plant Design

Definitions for the various requirements shown in this model are as follows:

Current licensing bases. The set of NRC requirements applicable to the plant, and the licensee's written commitments for assuring compliance with and operation within applicable NRC requirements and the plant-specific design basis (including all modifications and additions to such regulations, orders, license conditions, exemptions, and technical specifications). It also includes the plant-specific design basis information defined in 10CFR50.2 as documented in the most recent UFSAR as required by 10CFR71 and the licensee's commitments remaining in effect that were made in docketed licensing correspondence, such as licensee responses to NRC Bulletins, Generic Letters, and enforcement actions, as well as licensee commitments documented in NRC safety evaluations or licensee event reports. (Taken [with some minor editorial modification] from the definition of current licensing basis in GL 91-18, Rev 1.)

Design bases. Design bases are the fundamental requirements for a system or structure that define the bounding parameters that ensure owner and regulatory requirements are met. The design bases include the following:

> Design bases as defined by 10CFR50.2, "Information that identifies the specific functions to be performed by a structure, system, or component of a facility and the specific values or range of values chosen for controlling parameters as reference bounds for design. These values may be (1) restraints derived from generally accepted state-of-the-art practices for achieving functional goals or (2) requirements derived from analysis (based on calculation and/or experiments) of the effects of a postulated accident for which a structure, system, or component must meet its functional goals."

Engineering design bases. The entire set of design constraints that are implemented, including those that are (1) part of the current licensing bases and form the bases for the [regulator] staff's safety judgments and (2) those that are not included in the current licensing bases but are implemented to achieve certain economies of operation, maintenance, procurement, installation, or construction. (As defined in NUREG-1397.)

Technical requirements. These parameters define the function or performance of a given SSC in a particular application/end-use or group of applications/end-uses. Figure 2-2 illustrates that the selection of design inputs, design/analysis, calculation, and/or specification development will result in technical requirements. Examples of resulting technical requirements are also illustrated.

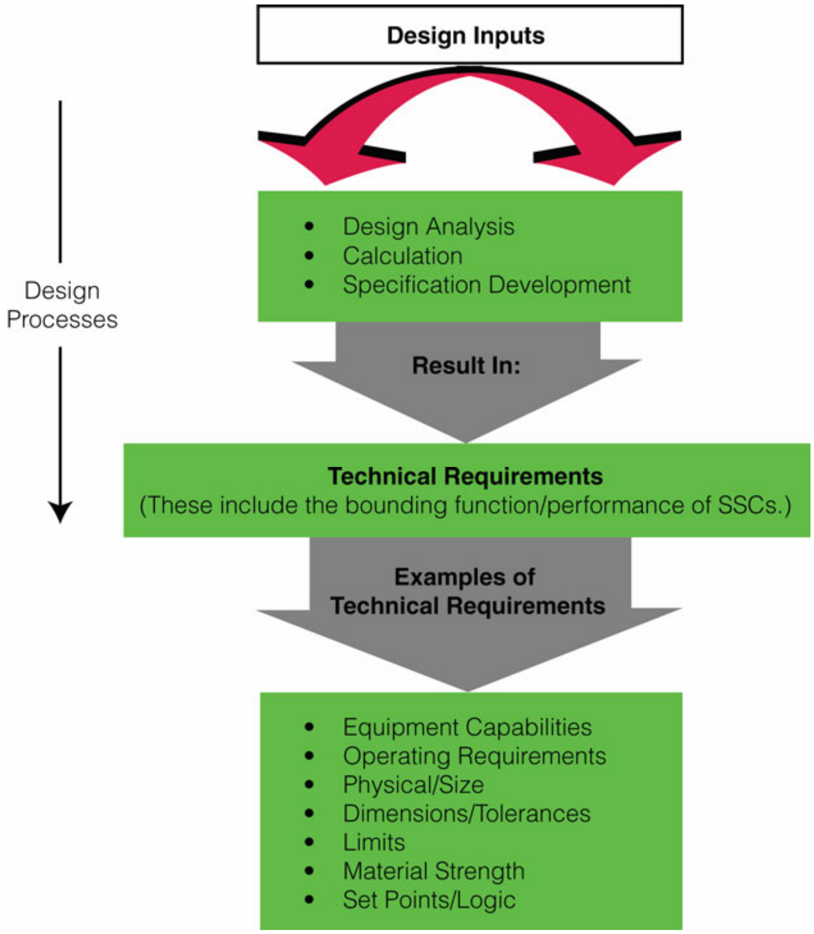


Figure 2-2
Technical Requirements

2.1.2 Bounding Parameters

Figure 2-3 illustrates the bounding parameters of the design basis (see the definition of design bases in Section 2.1.1) when applied to the hierarchy model. Note that the design basis for a given end-use defines the applicable technical requirements. In other words, the design bases bound a subset of technical requirements that define the function or performance of a given SSC.

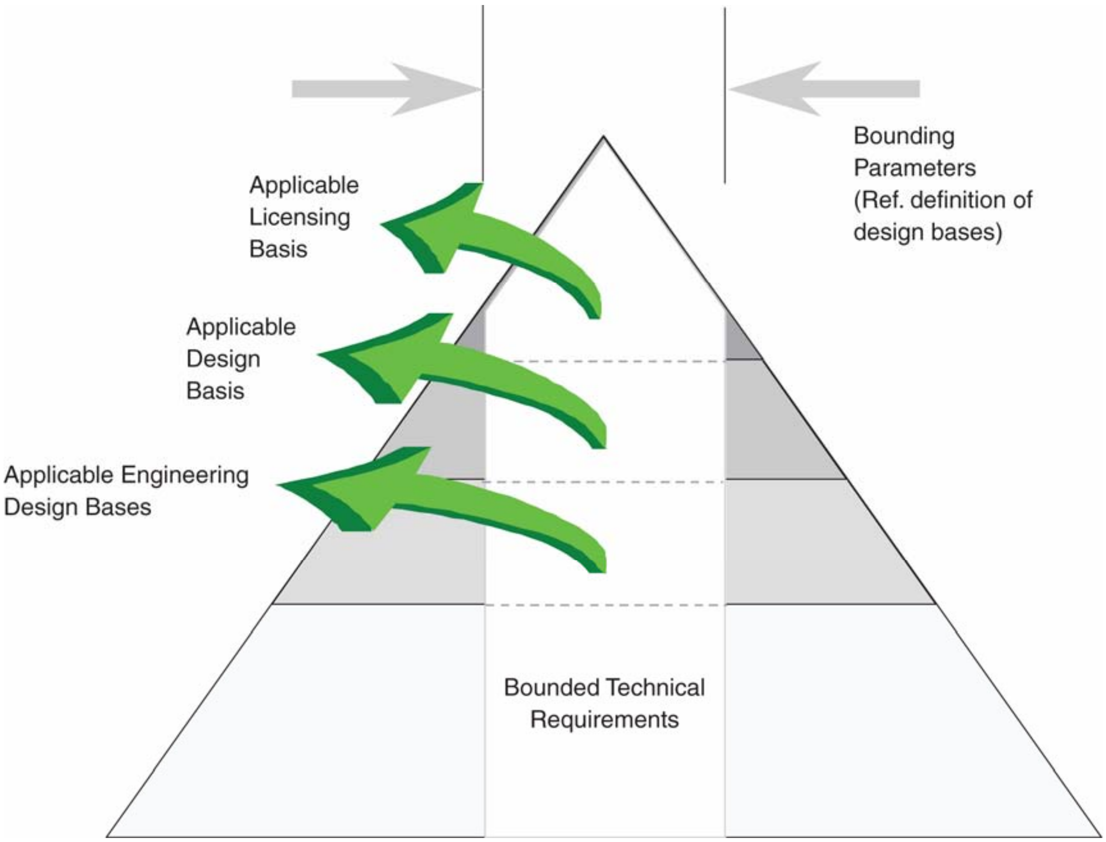


Figure 2-3
Bounding Parameters

2.1.3 Definitions for Types of Engineering Changes

Administrative document-only change. An inconsequential revision to a controlled engineering document that does not affect the design, function, or method of performing the function of an SSC.

Design change. A change to those bounded technical requirements that (1) ensure performance of design basis functions or (2) ensure compliance with the plant licensing basis.

Figure 2-4 illustrates a type of engineering change involving change(s) to some bounded technical requirement(s). These engineering changes are defined as design changes for the purposes of this report. The figure also illustrates that although some bounded requirements change, the applicable design basis is maintained, and compliance to the applicable licensing basis is maintained when the design change process is implemented correctly. The figure also depicts that a design change might result in either a hardware change to plant SSCs or a document-only change.

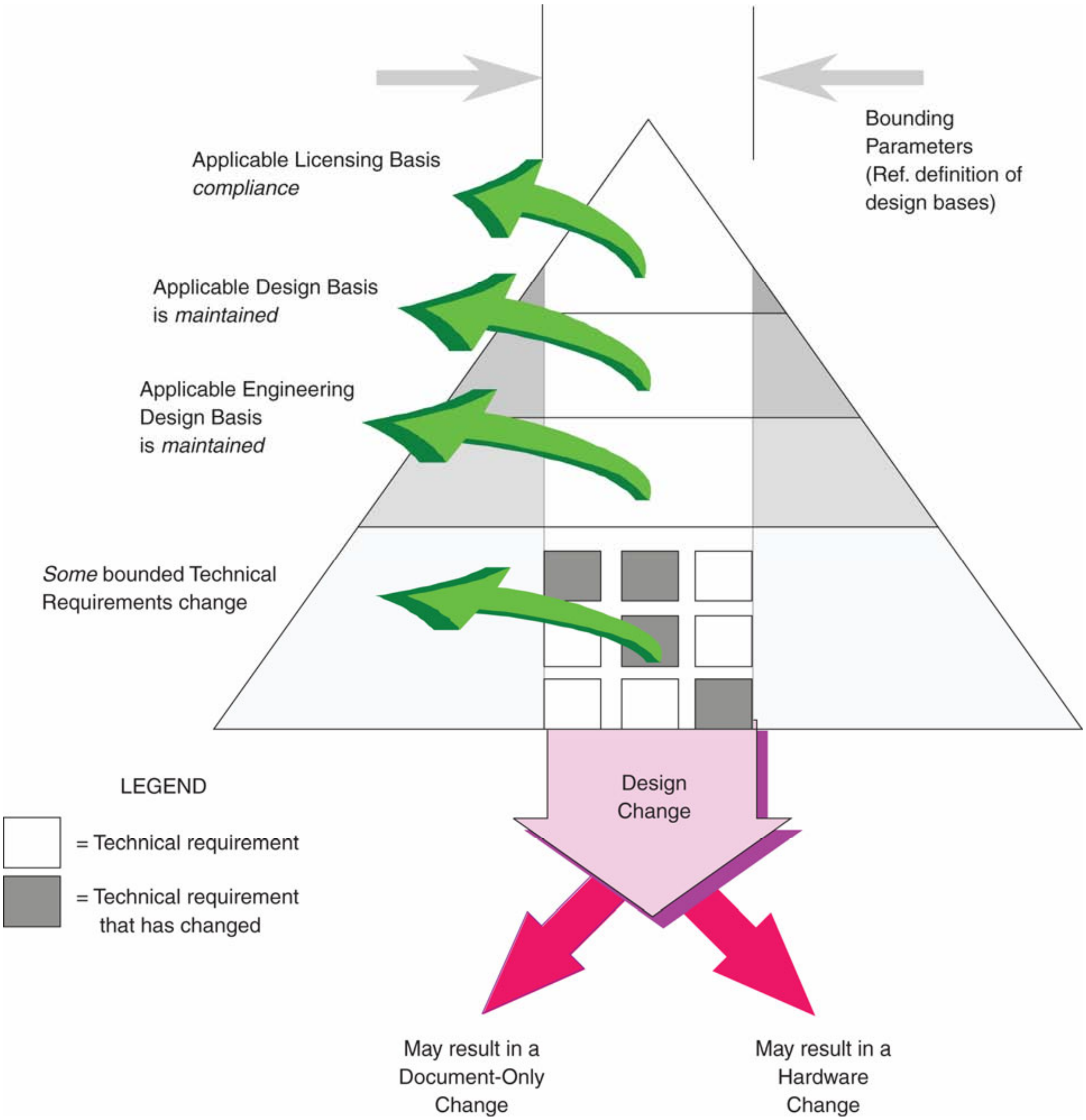


Figure 2-4
Design Changes

Document-only change. A change to a controlled engineering document that does not also involve or result in a hardware change.

Engineering change. Any change to a structure, system, or component including design changes, document-only changes, and equivalent changes.

Equivalent change. A change that does **not** result in an adverse change to those bounded technical requirements that (1) ensure performance of design basis functions or (2) ensure compliance with the plant licensing bases of either the item(s) or applicable interfaces.

Figure 2-5 illustrates a type of engineering change involving no change(s) to any bounded technical requirement(s). These engineering changes are defined as equivalent changes for the purposes of this report. In this case, the technical requirements that changed were outside those bounded requirements that defined the function or performance of a given SSC in this particular application. The figure also illustrates that, because no bounded requirements change, the applicable design basis and applicable licensing basis are not affected. The figure shows that an equivalent change may still result in a physical change to plant SSCs, or a revision to plant documents, or both.

Generic change. An engineering change applied to a number of different applications, usually over an extended period of time.

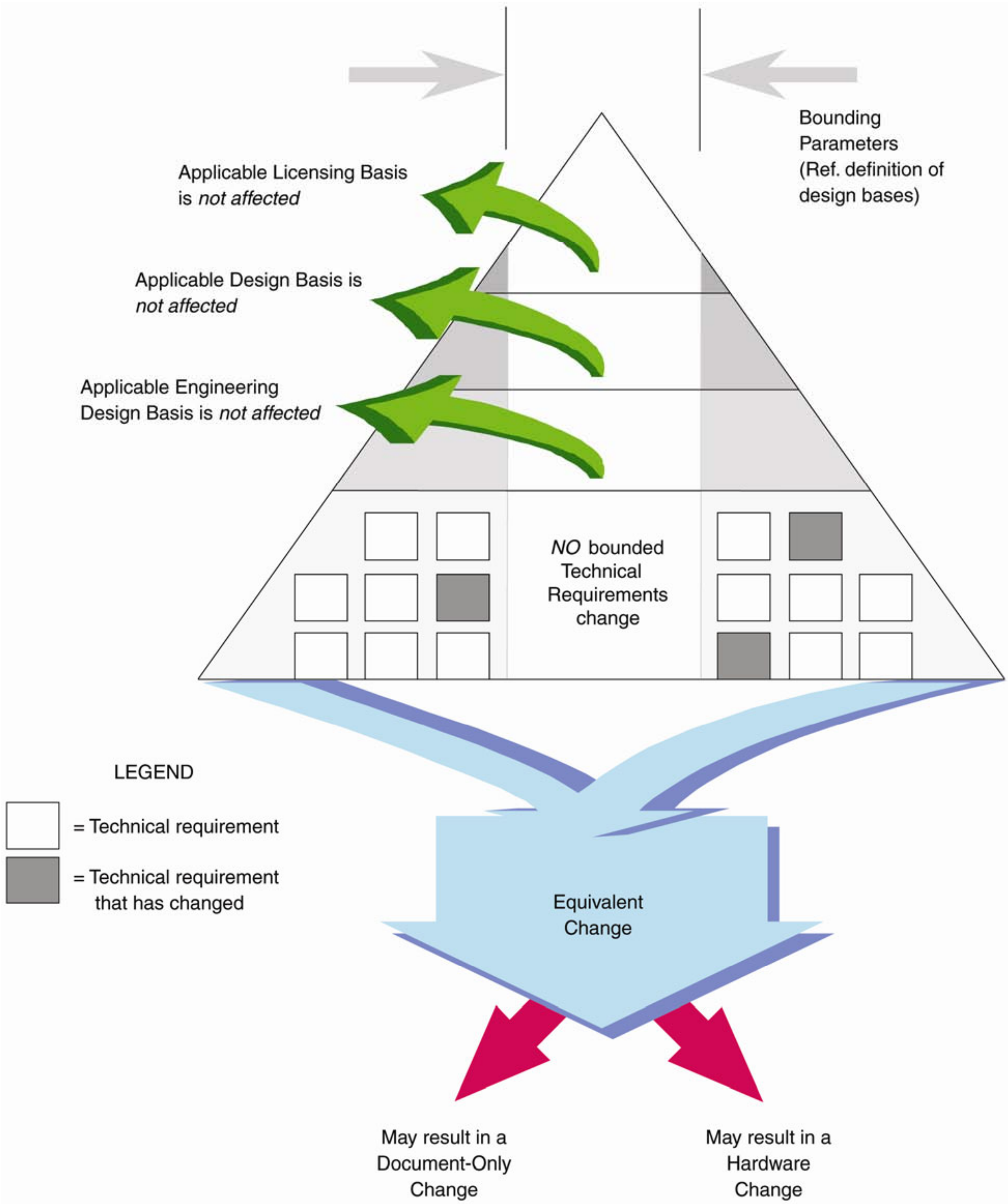


Figure 2-5
Equivalent Changes

2.2 Glossary

Closeout process. The process that provides assurance that all drawings, procedures, specifications, calculations, databases, design basis documents, and other items affected by a change are identified for update and then updated.

Commercial controls. The codes, standards, and good engineering practices typically applied during the design of structures, systems, and components outside of the nuclear jurisdiction. They can include national standards, such as the Uniform Building Code, site-specific local and state standards, and other utility-defined design controls.

Controlled plant equipment (CPE). Structures, systems, and components that:

- Are safety-related, or
- Whose functions impact the plant safety analysis, or
- Other structures, systems, and components that are subject to special consideration based on management discretion (for example, considerations given to licensing basis, the Maintenance Rule, personnel safety, availability, commercial risk).

Design functions. UFSAR-described design bases functions and other SSC functions described in the UFSAR that support or impact design bases functions. Implicitly included within the meaning of design function are the conditions under which intended functions are required to be performed, such as equipment response times, process conditions, equipment qualification and single failure. (As described in NEI 96-07, Revision 1.)

Design input. Those criteria, parameters, bases, or other design requirements on which detailed final design is based. (From ANSI N45.2.11-1974.)

Design output. Documents such as drawings, specifications, and other documents defining technical requirements of structures, systems, and components as delineated in Section 4 of ANSI N45.2.11. (From ANSI N45.2.11-1974.)

Design verification. The process of reviewing, confirming, or substantiating the design by one or more methods to provide assurance that the design meets the specified design inputs. Independent verification is performed by any competent individuals or groups other than those who performed the original design but who may be from the same organization. (From ANSI N45.2.11-1974.)

Engineering review screen. An aid to determine whether additional programmatic review or assistance should be considered in a particular subject area. It assists in determining where additional, specific engineering review is necessary to ensure that programmatic commitments are maintained. Examples of such programs include fire protection, equipment qualification, and ALARA (as low as reasonably achievable).

Field change request (FCR). The process of identifying and resolving, including review and approval as needed, changes to the engineering change package made after its release for implementation.

Hardware change. A physical change to SSCs, including instrument set-point changes and electronic software changes.

Independent review. Review completed by personnel not having direct responsibility for the work function under review regardless of whether they operate as a part of an organizational unit or as individual staff members. (From ANSI N18.7-1976/ANS 3.2.)

Outside of controlled plant equipment. Structures, systems, and components that are not CPE.

Programmatic review. Topical review of a technical issue or group of issues to ensure that program commitments are evaluated and maintained. Examples of such programs include fire protection and equipment qualification.

Scoping screen. An aid to determine the extent and content of the engineering change package. It assists in determining whether or not a change package should include a conceptual design, alternate design evaluation, interdisciplinary review, and other nonmandated good practices and actions.

10CFR50.59 screen. The process for determining whether a proposed activity requires a 10CFR50.59 evaluation to be performed. (From NEI 96-07 Revision 1.)

10CFR50.59 evaluation. A 10CFR50.59 evaluation is the documented evaluation against the eight criteria in 10CFR50.59(c)(2) to determine whether a proposed change test or experiment requires prior NRC approval via license amendment under 10CFR50.59. (From NEI 96-07 Revision 1.)

10CFR50.71 screen. An evaluation performed to determine whether an engineering change modifies information presented in the UFSAR.

Utility Appendix B program. Refers to the nuclear quality assurance program that all utilities operating in the commercial nuclear sector are required to maintain based on Appendix B of 10CFR50.

2.3 Conversion Factors

Table 2-1 presents conversion factors used to convert values between English and Standard International units.

Table 2-1
Conversion Factors Used in This Report

Parameter	English to Standard International Units
Flow rate	1 gpm = 8.021 cubic feet per hour 1 gpm = 0.063 liters per second
Length	1 in. = 25.4 mm
Pressure	1 psi = 6.89 kPa
Radiation	1 rad = 0.01 grays
Temperature	°F = (°C x 9/5) + 32 °F = 1.8 (°C) + 32 °C = (°F - 32) x 5/9
Weight	1 lb = 0.45 kg

3
REGULATIONS AND INDUSTRY GUIDELINES THAT INFLUENCE THE ENGINEERING CHANGE PROCESS

This section of the guideline describes the regulations that impact the engineering change process. In addition, it addresses the guidance contained in various documents developed through a number of other industry initiatives. In some cases, these guidance documents have been translated in utility engineering change programs as mandates, and the distinction between real and perceived regulatory requirements has become less clear. In addition, perceived requirements have been added to engineering change programs as a result of regulatory findings or fixes to one-time plant events.

Many documents were evaluated to determine their impact on the engineering change process. The following have primary impact and are described in the following text:

- 10CFR50.59, *Changes, Tests and Experiments*
- 10CFR50 Appendix B, *Nuclear Quality Assurance Requirements*
- ANSI N18.7, *Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants*
- ANSI N45.2.11, *Quality Assurance Requirements for the Design of Nuclear Power Plants*
- ASME NQA-1, *Quality Assurance Program for Nuclear Facilities*
- Generic Letter 91-18, Revision 1, *Information to Licensees Regarding NRC Inspection Manual Section on Resolution of Degraded and Nonconforming Conditions*
- 10CFR50.71, *Maintenance of Records, Making of Reports*
- INPO and EPRI Guidelines
- NEI 96-07 Revision 1, *Guidelines for 10CFR50.59 Implementation*
- NRC Inspection Modules
- Regulatory Guide 1.187, *Final Regulatory Guide on Implementation of 10CFR50.59 (Changes, Tests, and Experiments)*

The purpose of this section is not to provide definitive guidance on the various regulations and documents, or even to summarize them in their entirety. Rather, the explanation is limited to their impact on the engineering change process.

3.1 10CFR50.59; Changes, Tests, and Experiments

Licensees are allowed to make changes to the facility without prior NRC approval, provided that the conditions set forth in 10CFR50.59 are addressed acceptably. Since the issuance of the original and Revision 1 of TR-103586, a great deal of effort has been expended by the NRC and the industry to develop improved guidance on the implementation of 10CFR50.59. The NRC amended its regulation concerning changes, tests, and experiments at nuclear power plants on October 4, 1999 (64 FR 53582). The Nuclear Energy Institute (NEI) continued its 96-07 Initiative with *Guidelines for 10CFR50.59 Implementation* (NEI 96-07 Revision 1), published in November of 2000. NEI 96-07 is based on guidance previously developed by EPRI and reported in NSAC-125, modified to address NRC comments and concerns. The NRC published Regulatory Guide 1.187 with an effective date of March 13, 2001, which endorsed NEI 96-07 Revision 1 as providing methods acceptable to the NRC staff for complying with the provisions of 10CFR50.59.

The new (c)(4) provision of the revised 10CFR50.59 regulation recognizes that other regulatory requirements provide a framework of processes for evaluating certain changes, either by establishing specific change control criteria or by defining the requirements that must be satisfied. NEI 96-07 Revision 1 states, "Together with 10CFR50.59, these processes form a framework of complementary regulatory controls over the licensing basis. To optimize the effectiveness of these controls and minimize duplication and undue burden, it is important to understand the scope of each process within the regulatory framework."

After determining that the activity is safe and effective, the relevant steps in the 10CFR50.59 process apply. The process involves determining whether the item falls under the scope of 10CFR50.59, screening the changes, and evaluating the changes that have adverse impacts to the design functions or constitute a change in methodology. The evaluation considers the amount of adverse impact, the likelihood of increased frequency of the failures and those consequences, any new results of the activity, whether the design basis limits are exceeded, and whether the activity is a departure from a UFSAR described method of evaluation. The relevant revisions are identified in the following text.

The following options are available to the licensee when one of the eight criteria of 10CFR50.59(c)(2) has not been met:

- Discontinue the proposed activity.
- Revise the activity such that all eight criteria are met.
- File a license amendment.

In summary, the 10CFR50.59 process is applied to determine whether a license amendment is required prior to implementation. The process includes the following:

- Applicability and screening to determine whether a 10CFR50.59 evaluation is required
- Evaluation by applying the eight evaluation criteria of 10CFR50.59(c)(2) to determine whether a license amendment must be obtained from the NRC
- Documenting and reporting to the NRC activities implemented under 10CFR50.59.

3.1.1 Applicability of 10CFR50.59 to Licensee Engineering Change Activities

Section 4.1.1 of NEI 96-07 Revision 1 states the following:

> 10CFR50.59 is applicable to tests or experiments not described in the UFSAR and to changes to facility or procedures as described in the UFSAR, including changes made in response to new requirements or generic communications, except as noted below:
>
> - Per 10CFR50.59(c)(1)(i), proposed activities that require a change to the technical specifications must be made via the license amendment process, 10CFR50.90. Aspects of proposed activities that are not directly related to the required technical specification change are subject to 10CFR50.59.
>
> - To reduce duplication of effort, 10CFR50.59(c)(4) specifically excludes from the scope of 10CFR50.59 changes to the facility or procedures that are controlled by other more specific requirements and criteria established by regulation. For example, 10CFR50.54, which was promulgated after 10CFR50.59, specifies criteria and reporting requirements for changing quality assurance, physical security and emergency plans.
>
>   – 10CFR50.65 (Maintenance Rule). See additional discussion in Section 4.1.2.
>
>   – 10CFR Part 50, Appendix B (Quality Assurance Criteria). See additional discussion in Section 4.1.4.
>
>   – Standard FP license condition (if applicable). See additional discussion in Section 4.1.5.
>
>   – 10CFR50.55a (Codes and Standards)
>
>   – 10CFR50.46 (ECCS Rule)
>
>   – 10CFR50.12 (Specific Exemptions)
>
>   – 10CFR Part 20 (Standards for Radiation Protection).

In addition to 50.59 and 50.54(a), (p) & (q), the following include change control requirements that meet the intent of 50.59(c)(4) and may take precedence over 50.59 for control of specific changes:

> Activities controlled and implemented under other regulations may require related information in the UFSAR to be updated. To the extent the UFSAR changes are directly related to the activity implemented via another regulation, applying 10CFR50.59 is not required. UFSAR changes should be identified to the NRC as part of the required UFSAR update, per 10CFR50.71(e). However, there may be certain activities for which a licensee would need to apply both the requirements of 10CFR50.59 and that of another regulation. For example, a modification to a facility involves additional components and substantial piping reconfigurations as well as changes to protections system set points. The protections system set points are contained in the facility technical specifications. Thus, a license amendment to revise the technical specifications under 10CFR50.90 is required to implement the new set points. 10CFR50.59 should be applied to the balance of the modification, including impacts on required operator actions.

According to NEI 96-07 Revision 1, Section 4.1.2, 10CFR50.59 does not apply to maintenance activities. NEI 96-07 Revision 1 states the following:

> Maintenance activities are activities that restore SSCs to their as-designed condition, including activities that implement approved design changes. Maintenance activities are not subject to 10CFR50.59, but are subject to the provisions of 10CFR50.65(a)(4) as well as technical specifications.
>
> Maintenance activities include troubleshooting, calibration, refurbishment, maintenance-related testing, identical replacements, housekeeping and similar activities that do not permanently alter the design, performance requirements, operation or control of SSCs. Maintenance activities also include temporary alterations to the facility or procedures that directly relate to and are necessary to support the maintenance. Examples of temporary alterations that support maintenance include jumpering terminals, lifting leads, placing temporary lead shielding on pipes and equipment, removal of barriers, and use of temporary blocks, bypasses, scaffolding and supports.”

3.1.2 Screening

Section 4.2 of NEI 96-07 Revision 1 includes the following guidance for screening:

> Once it has been determined that 10CFR50.59 is applicable to a proposed activity, screening is performed to determine if the activity should be evaluated against the evaluation criteria of 10CFR50.59(c)(2).

> Engineering, design and other technical information concerning the activity and affected SSCs should be used to assess whether the activity is a test or experiment not described in the UFSAR or a modification, addition, or removal (i.e., change) that affects:
>
> - A design function of an SSC
> - A method of performing or controlling the design function, or
> - An evaluation for demonstrating that intended design functions will be accomplished.
>
> Sections 4.2.1 and 4.2.2 provide guidance and examples for determining whether an activity is (1) a change to the facility or procedures as described in the UFSAR or (2) a test or experiment not described in the UFSAR. If an activity is determined to be neither, then it screens out and may be implemented without further evaluation under 10CFR50.59. Activities that are screened out from further evaluation under 10CFR50.59 should be documented as described in Section 4.2.3 of NEI 96-07.

A Key issue relative to 10CFR50.59 for purposes of optimizing the engineering change process is to ensure that appropriate screening criteria are used, thereby ensuring that all changes that might require a license amendment prior to implementation are identified. NEI 96-07 Revision 1 provides the following guidance for developing screening criteria and questions:

> To determine whether or not a proposed activity affects a design function, method of performing or controlling a design function or an evaluation that demonstrates that design functions will be accomplished, a through understanding of the proposed activity is essential. A given activity may have both direct and indirect effects that the screening review must consider. The following questions illustrate the range of effects that may stem from a proposed activity:
>
> - Does the activity decrease the reliability of an SSC design function, including either functions whose failure would initiate a transient/accident or functions that are relied upon for mitigation?
> - Does the activity reduce existing redundancy, diversity or defense-in-depth?
> - Does the activity add or delete an automatic or manual design function of the SSC?
> - Does the activity convert a feature that was automatic to manual or vice versa?
> - Does the activity introduce an unwanted or previously unreviewed system or materials interaction?
> - Does the activity adversely affect the ability or response time to perform required actions, for example, alter equipment access or add steps necessary for performing the tasks?
> - Does the activity adversely affect other units at a multiple unit site?

- Does the activity affect a method of evaluation used in establishing the design bases or in the safety analyses?

- For activities affecting SSCs, procedures, or methods of evaluation that are not described in the UFSAR, does the change have an indirect effect on electrical distribution, structural integrity, environmental conditions or other UFSAR-described design functions?

The screening process does not consider the magnitude of adverse effects that are identified. Any change that adversely affects a UFSAR described design function, method of performing or controlling a design function, or evaluation that demonstrates that an intended design function will be accomplished is screened in. The magnitude of the adverse effect is the focus of the 10CFR50.59 evaluation process.

The previous revision of NEI 96-07 identified *replacement with equivalent component* as a maintenance activity, which meant that it was not subject to the requirements of 10CFR50.59. NEI 96-07 Revision 1 does not consider an equivalent replacement a maintenance activitiy; therefore, screening in accordance with 10CFR50.59 is required.

NEI 96-07 Revision 1 provides the following guidance relative to equivalent replacements:

> Equivalent replacement is a type of change to the facility that does not alter the design function of SSCs. Licensee equivalence assessments, for example, consideration of performance/operation characteristics and other factors, may thus form the basis for screening determinations that no 10CFR50.59 evaluation is required.

Section 4.2.3 of NEI 96-07 Revision 1 addresses the necessary documentation requirements as follows:

> 10CFR50.59 record-keeping requirements apply to 10CFR50.59 evaluations performed for activities that screened in, not to screening records for activities that screened out. However, documentation should be maintained in accordance with plant procedures of screenings that conclude a proposed activity may be screened out (i.e., that a 10CFR50.59 evaluation was not required). The basis for the conclusion should be documented to a degree commensurate with the safety significance of the change. For changes, the documentation should include the basis for determining that there would be no adverse affect on design functions, etc. Typically, the screening documentation is retained as part of the change package. This documentation does not constitute the record of changes required by 10CFR50.59, and thus is not subject to 10CFR50.59 documentation and reporting requirements. Screening records need not be retained for activities for which a 10CFR50.59 evaluation was performed or for activities that were never implemented.

3.1.3 Summary of Requirements

Following a review of the guidance in NEI 96-07 Revision 1, the following conclusions—which impact the use of 10CFR50.59 screens in the engineering change process—were reached:

- The 10CFR50.59 screen should be applied to a broad range of changes to ensure that all changes that have the potential to result in an adverse impact to design functions are identified, and those that do not adversely impact design functions are screened out.
- Changes to non-safety-related systems, structures, and components might require screening or performance of a 10CFR50.59 evaluation if the change might affect the functional capability or qualification of structures, systems, or components described in the UFSAR, whether safety-related or not.
- Changes that might affect inputs to the plant accident analyses (such as assumed operating parameters for faulted non-safety-related systems, or failure rates for faults in non-safety-related systems that are event initiators) require screening or performance of 10CFR50.59 evaluations.
- Replacement of an equivalent item is a type of change to the facility that does not alter the design functions of SSCs. Licensee equivalency assessments—for example, consideration of performance/operating characteristics and other factors—can form the basis for screening determinations that no 10CFR50.59 evaluation is required. Permanent removal of components described in the UFSAR or changes that adversely affect the design function of a component cannot be considered equivalent changes.
- Use-as-is dispositions of nonconformance that result in something different than described in the UFSAR are subject to 10CFR50.59.

The guidance provided in NEI 96-07 does impact previous recommendations in TR-103586, particularly in the determination of the set of changes to which the 10CFR50.59 screen must be applied. These impacts and supplemental guidance related to them are provided in Section 4.

3.2 10CFR50 Appendix B, Nuclear Quality Assurance Requirements

Appendix B to 10CFR50 establishes quality assurance (QA) requirements for the design, construction, and operation of "structures, systems and components that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public." These structures, systems, and components are generally referred to as safety-related. The following two sections of 10CFR50 Appendix B have primary impact on the engineering change process:

- Section III, Design Control. This section, in part, requires that quality standards be specified and included in design documents, that the design process be controlled, that design control measures provide for independent design verification and checking the adequacy of design, and that field changes be subject to the same controls as the original design.
- Section VI, Document Control. This section, in part, requires control over the issuance of documents including that documents be reviewed for adequacy and approved for release and that document changes are reviewed and approved by the same organizations that performed the original review (unless otherwise designated).

In relation to the engineering change process, 10CFR50 Appendix B has two important impacts:

- It applies only to safety-related equipment, which it defines as structures, systems, and components that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. This differentiates that population of structures, systems, and components from the rest of the structures, systems, and components in the plant. The requirements of 10CFR50 Appendix B need not, therefore, be applied to all plant areas.
- It establishes a clear requirement for review of the adequacy of design changes to structures, systems, and components within the scope of 10CFR50 Appendix B. This review requirement is interpreted in ANSI N45.2.11 as an independent design verification. The key point is that the review requirement does not apply to changes made to structures, systems, and components outside of 10CFR50 Appendix B.

Additional structures, systems, and components are often placed within the purview of the utility's 10CFR50 Appendix B QA Program. This is done at the utility's discretion. In some cases, the requirements are fully applied, and in other cases only parts of the utility's 10CFR50 Appendix B QA Program apply. These items are generally referred to as items that are not safety related but are considered "important to safety" or "augmented quality" items.

3.3 ANSI N18.7, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants

NRC Regulatory Guide 1.33, Revision 2, *Quality Assurance Program Requirements (Operational)*, promulgates the following regulatory position:

> The overall quality assurance program requirements for the operating phase (of nuclear power plants) included in ANSI N18.7 are acceptable to the NRC staff and provide an adequate basis for complying with the quality assurance requirements of Appendix B to 10CFR50....

Section 5.2 of ANSI N18.7 requires that design activities associated with modifications of safety-related structures, systems, and components be accomplished in accordance with ANSI N45.2.11, which is explained in the next section. However, ANSI N18.7 also includes requirements in the area of equivalent changes. Section 5.2 stipulates for equivalent changes that an evaluation be conducted to ensure that interfaces, interchangeability, safety, fit, and function are not adversely affected or contrary to applicable regulatory or code requirements. Further, the results of this evaluation are required to be documented.

3.4 ANSI N45.2.11, Quality Assurance Requirements for the Design of Nuclear Power Plants

NRC Regulatory Guide 1.64, Revision 2, *Quality Assurance Requirements for the Design of Nuclear Power Plants*, promulgates the following regulatory position:

> The requirements and recommendations for establishing and executing a quality assurance program during the design phase of nuclear power plants that are included in ANSI N45.2.11 are acceptable to the NRC staff and provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10CFR50....

ANSI N45.2.11, therefore, provides the basis for meeting the requirements of 10CFR50 Appendix B for design control. Among other things, ANSI N45.2.11 defines design input as "those criteria, parameters, bases or other design requirements upon which detailed final design is based." It requires in paragraph 3.1 that the design input "shall be identified, documented and their selection reviewed and approved." Further, it defines a method for performing an independent design verification that satisfies the requirements for an adequacy review in 10CFR50 Appendix B.

The points made in the last paragraph are important in that they (1) require that design inputs be documented for design changes within the scope of 10CFR50 Appendix B, and (2) require independent design verification of design changes, providing an acceptable method for accomplishing the same. Of equal importance is that ANSI N45.2.11 is not applicable to changes made outside of the structures, systems, and components within the scope of 10CFR50 Appendix B.

ANSI N45.2.11 can also be used to determine what constitutes a design change versus an equivalent change. One option considered for defining design change was "a change to any final design output document," using the following ANSI N45.2.11 definitions for *design* and *design output*:

> **Design**: The technical and management process which commences with identification of design input and which leads to and includes the issuance of design output documents.
>
> **Design output**: Documents such as drawings, specifications, and other documents defining technical requirements of structures, systems, and components as delineated in Section 4 (of N45.2.11).

Such a definition for design change, however, would be impractical and overly conservative. A substantial amount of the technical information included in design output documents is not related to ensuring that design basis functions are properly performed. The specific technical requirements that are necessary to ensure performance of the design basis functions of the structure, system, or component are a small subset of all the technical requirements included in design output documents. Requirements in design output documents include specific configuration details, commercial requirements, and other requirements that are unimportant from a design basis function standpoint. Changes to requirements included in design output documents that are not related to the performance of design basis functions should not be considered design changes. (An example illustrating this case is included in Section C.2.) However, utilities are required to maintain controls for changes to design output documents commensurate with those applied to the original documents. These changes to controlled design documents are required to comply with Section 7 of ANSI N45.2.11 as defined in the site document control procedures.

This guideline bases the determination of whether an engineering change is an equivalent change or a design change on evaluation of whether or not the change meets that subset of technical requirements that (1) ensure compliance with the plant licensing basis and (2) ensure that the plant configuration remains within the bounding parameters of the plant design basis.

This subset of technical requirements is referred to in this guideline as the bounded technical requirements. These technical requirements are established through engineering activities that translate the values chosen as reference bounds for design of controlling parameters (that is, the design bases as defined in 10CFR50.2) into specific requirements included in such documents as specifications, drawings, and other design output documents. Engineering changes that alter any of those technical requirements included in design output documents are controlled by the bounding values selected in the design and licensing basis of the plant are considered design changes. Engineering changes that do not alter the bounded technical requirements in design output documents are considered equivalent changes.

This approach ensures that all changes that can affect the plant design bases or licensing bases are processed as design changes, yet it allows changes to be made to the plant and related design output documents that do not affect design basis functions or the plant licensing bases to be made as equivalent changes. This approach is consistent with the 10CFR50.2 definition of design bases, and is compatible with ANSI N18.7 and ANSI N45.2.11. The approach avoids using unnecessarily strict screening criteria that would consider any change to a design output document (such as a specification or drawing) to be processed as a design change. This approach is also consistent with guidance provided in NEI 96-07, Revision 1.

Additional guidance on design bases may be found in Regulatory Guide 1.186, *Guidance and Examples for Identifying 10CFRF50.2 Design Bases*, and NEI 97-04, *Design Bases Program Guidelines*.

3.5 ASME NQA-1, Quality Assurance Program for Nuclear Facilities

ASME NQA-1 is a quality assurance program that was developed subsequent to 10CFR50 Appendix B. NRC requirements allow the use of NQA-1 as an alternate to 10CFR50 Appendix B and as an acceptable basis for licensee QA programs. Nearly all utility QA programs are still based on 10CFR50 Appendix B, however, and for this reason, NQA-1 is not addressed in detail in this report. Any users of this report who are subject to NQA-1 requirements are cautioned to review the guidance in this report carefully prior to implementation to ensure that it complies with NQA-1 program requirements.

3.6 Generic Letter 91-18, Revision 1, Information to Licensees Regarding NRC Inspection Manual Section on Resolution of Degraded and Nonconforming Conditions

This generic letter revision was issued on October 8, 1997. It deals primarily with a clarification of the NRC's position on continued plant operation or restart from a shutdown with degraded or nonconforming conditions. It also modifies guidance for NRC inspectors in Part 9900 of the NRC Inspection Manual. Most of the information provided is unrelated to the engineering change process, with the exception of the definition of current licensing basis, which is provided in Section 2.1.1 of this report.

3.7 10CFR50.71, Maintenance of Records, Making of Reports

Subsection 50.71(e) of this section of the Code of Federal Regulations requires licensees to submit periodic updates of the plant final safety analysis report. In order to comply with this section of 10CFR50, the engineering change process must have provisions to capture (1) changes that affect descriptions included in the UFSAR, (2) changes that affect analyses included in the

UFSAR, (3) evaluations performed in support of requested license amendments, and (4) analyses of new safety issues. Controls used in the engineering change process must ensure that these changes are properly captured and included in the UFSAR update process.

The range of plant equipment described in the UFSAR varies from plant to plant, but typically covers a broad range of plant systems, structures, and components well beyond the safety-related equipment boundaries. Also, the level of detail at which the plant systems, structures, and components are described varies from plant to plant and in some cases includes very detailed information, down to identifying specific makes and models of equipment or describing subcomponent features (for example, RCP seal design). The UFSAR also includes descriptions of analyses, design or construction code requirements, quality assurance requirements, and qualification program requirements.

Given the scope of information contained in the UFSAR, it is feasible that any engineering change (design change, equivalent change, or administrative document-only change) might impact UFSAR information. Proper screening to identify UFSAR impacts should be performed for all engineering changes.

Guidance for updating the final safety analysis report may be found in Regulatory Guide 1.181, *Content of the Updated Final Safety Analysis Report in Accordance with 10CFR50.71(e)*, which endorses NEI 98-03 Revision 1, *Guidelines for Updating Final Safety Analysis Reports*.

3.8 INPO and EPRI Guidelines

Several INPO and EPRI-sponsored guidelines were developed to assist utilities in interpreting requirements, to cite and establish good practices to be shared, and to improve performance in the engineering change process. It is emphasized that the following documents do not establish any regulatory requirements. In the strictest sense, they are a set of suggestions and recommendations.

A list of the more significant guidance documents that were evaluated follows. This list is provided because the documents contain information helpful for utilities evaluating their engineering change program for improvement.

- INPO 85-013, *Good Practice, Plant Modification Control Program*

  INPO 85-013 provides recommendations relative to controls to ensure that potential improvements in the plant are designed, reviewed, approved, installed, and operated in a safe and reliable manner. It describes a detailed program to implement changes addressing the problem identification, conceptual design, detailed design, installation and testing, turnover to operations, and final closeout phases. It also contains a set of standard forms and the recommended contents of a typical change package.

- INPO 90-009, *Guidelines for the Conduct of Design Engineering*

  INPO 90-009 assists utilities in effectively managing design engineering support of their nuclear power plants.

- INPO 90-020, *Performance Objectives and Criteria for Corporate Evaluations* and INPO 97-002, *Performance Objectives and Criteria for Operating Nuclear Generating Stations*

  INPO 90-020 and 97-002 provide broad management objectives and more narrowly focused statements on criteria for desired activities that help meet the performance objectives. These documents are used by INPO for evaluations and assistance visits; the material is also useful as a guide for utility self-assessments.

- INPO AP-929, *Configuration Control Process Description*

  INPO AP-929 provides an overall process for managing station configuration, including design changes and design basis changes. This document includes suggestions for differentiating among operational, equivalent, and design changes.

- NSAC-105, *Guidelines for Design and Procedure Changes in Nuclear Power Plants*

  NSAC-105 helps utilities prepare and review an efficient change package and avoid the potential safety concerns inherent when designs or procedures are revised. It covers control of the design change, preparation of the change package, independent review of the change, and potential improvements to the change process.

- NSAC-125, *Guidelines for 10CFR50.59 Safety Evaluations*

  NSAC-125 has been superseded by NEI 96-07 Revision 1.

- EPRI NP-5640, *Nuclear Plant Modifications and Design Control: Guidelines for Generic Problem Prevention*

  EPRI report NP-5640 identifies generic problems encountered by utilities in the design change process and provides guidelines to prevent the occurrence of these problems.

- EPRI NP-6406, *Guidelines for the Technical Evaluation of Replacement Items in Nuclear Power Plants*

  EPRI report NP-6406 provides guidance for determining whether alternate replacement items that are not physically identical to the original items are suitable for use as equivalent replacements. Most current utility programs use the guidance provided in this report as the basis for their programs to evaluate the suitability of replacement items.

  NP-6406 provides guidance on several aspects of the evaluation of replacement items, including performance of component and part-level safety classification, determination of component functional modes, and determination of whether a replacement item is an identical or an alternate replacement item. The portions of NP-6406 that are most pertinent to the scope of this guideline are those sections that describe methods for determining whether the proposed replacement item is an equivalent item. One way to determine whether an alternate item is equivalent to the original is to compare the critical characteristics for design of the alternate against those of the original.

The term *critical characteristics for design* is defined in NP-6406 as follows:

> Critical characteristics for design are properties or attributes which are essential for the item's form, fit, and functional performance. These are identifiable and measurable attributes of a replacement item, which provide assurance that the replacement item will perform its design function.

NP-6406 describes the equivalency evaluation process in Section 3.5 as follows:

> The critical characteristics for design are determined based upon the item's function, its FMEA (if performed) and design documentation. Identified differences should be evaluated for their effect on the item's function(s) and failure mechanism(s)/mode(s). The critical characteristics for design comparison should include those design characteristics relating to an item's seismic and environmental qualifications, when applicable. The comparison may also require an understanding of the design basis in order to determine whether the characteristics of the alternate item meet or exceed those of the original. For example, an alternate item having a heat-treated surface harder than the original may not be equivalent if the original item was designed to wear faster than adjacent parts.

The development of the concept of critical characteristics for design was necessary to address situations in which the specifications and other design output documents for the specific item being procured are not controlled under the utility's design control program. This is commonly the case for subcomponents and parts of plant components. Utility design control for items of this type typically occurs at a higher level, such as the component or system level at which plant specifications were prepared during the design and construction process. Determination and evaluation of critical characteristics for design of replacement items that do not have specifications and drawings controlled within the utility's design control program provides a basis for concluding whether or not the replacement items are equivalent to items currently installed in the plant from a form, fit, performance, and qualification standpoint.

At the component or system level, where the design output documents (such as specifications and configuration drawings) are typically controlled by the utility's design control program, the technical requirements included in those design output documents can be used to determine whether installation of a replacement item is equivalent or constitutes a design change. No determination of critical characteristics for design is required in these cases, as the technical requirements related to design basis functions and licensing basis requirements (such as design codes) have already been determined through previous design activities and are included in the utility's design output and licensing basis documents.

In summary, the methodology included in NP-6406 is consistent with the overall guidance contained in this report. Where the utility's design control program applies and design output documents exist that identify the item's technical requirements, no determination of critical characteristics for design is required. Where the utility's design control program does not control the specific design output documents applicable to the item being replaced, determination of critical characteristics for design and evaluation of the replacement item against these characteristics is an acceptable means for determining equivalency.

- EPRI TR-102260, *Supplemental Guidance for the Application of EPRI Report NP-5652 on the Utilization of Commercial Grade Items*

  EPRI report TR-102260, Section 2, provides supplemental guidance regarding replacement item equivalency evaluations, such as when the equivalency evaluation is needed and how to determine critical characteristics for design. It also provides guidance on relating an item's critical characteristics to its form, fit, and functional performance.

3.9 NRC Inspection Modules

A number of NRC Inspection Modules were reviewed to determine whether any regulatory requirements or issues not already identified were explained or referenced. Inspection Module 37702, *Design Changes and Modification Program*, impacted most directly on the engineering change process. However, no new requirements or references to documents where requirements exist were identified.

3.10 Summary of Requirements

In summary, the regulatory requirements promulgated to govern the engineering change process are as follows:

- A 10CFR50.59 evaluation is required in cases where the change adversely impacts the safety analysis report. (Source: NEI 96-07 Revision 1, 10CFR50.59.) The screening process might be useful for efficient identification of changes needing a full 10CFR50.59 evaluation.
- Maintenance activities include troubleshooting, calibration, refurbishment, maintenance-related testing, identical replacements, housekeeping and similar activities that do not permanently alter the design, performance requirements, operation, or control of SSCs. (Source: NEI 96-07, Revision 1.)
- Equivalent changes are required to be evaluated and the evaluation must be documented. (Source: ANSI N18.7.)
- Equivalent changes are subject to 10CFR50.59 screening. However, a licensee's equivalency evaluation can be used as an alternate screening tool. (Source: NEI 96-07, Revision1). Please see the Addendum on page ix for cautions pertaining to this information.
- Design changes made to structures, systems, and components within the scope of 10CFR50 Appendix B are required to have an independent design verification. (Source: 10CFR50 Appendix B and ANSI N45.2.11.)

- Design changes made to structures, systems, and components within the scope of 10CFR50 Appendix B are required to have the design input documented, reviewed, and approved. (Source: ANSI N45.2.11.)
- Changes to controlled design output documents within the scope of 10CFR50 Appendix B are required to comply with Section 7 of ANSI N45.2.11 as defined by the site document control procedures.
- Changes that affect the descriptions in the UFSAR must be identified and included in the UFSAR update process. (Source: 10CFR50.71.)

The hierarchy of these requirements and the sequence in which they are invoked are shown in Figure 3-1.

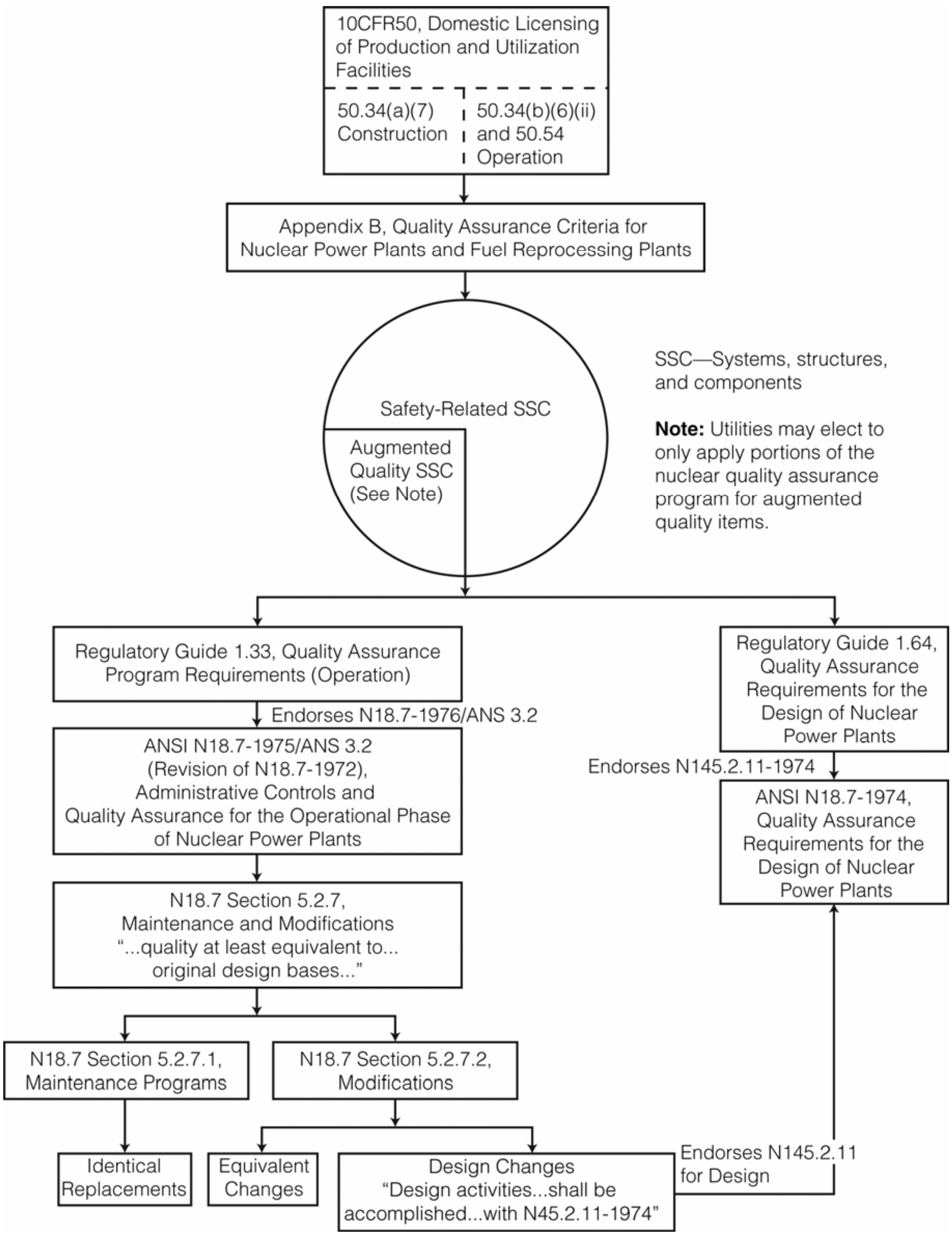


Figure 3-1
Regulatory Requirements Hierarchy Design and Quality Assurance Program

Table 3-1 shows these requirements and the types of engineering changes to which they apply. The types of engineering changes are described in Section 4.

Table 3-1
Engineering Change Requirements Matrix

Regulatory Requirements / Type of Change	10CFR50.71(e) Screen (Note 1)	10CFR50.59 Screen (Note 1) (Note 2) (Note 3)	ANSI N45.2.11 Design Input Approval (Note 4)	ANSI N45.2.11 Independent Design Verification (Note 4)	ANSI N45.2.11 Design Output Approval (Note 4)	ANSI N18.7 Documentation and Independent Review (Note 4)
Administrative Document-Only Change	X					
Change Outside Controlled Plant Equipment	X	X				
Equivalent Change	X	X (Note 3)			X (Note 5)	X (Note 6)
Design Change	X	X	X	X	X (Note 5)	

Notes:

1. These screens may be performed at any time based on each utility's plant-specific procedures.
2. The purpose of the 10CFR50.59 screen is to determine whether a full 10CFR50.59 evaluation is required or not and to document the basis for not performing a 10CFR50.59 evaluation when one is not required.
3. Performance and documentation of an equivalency evaluation may meets the intent of a 10CFR50.59 screen because the equivalency evaluation confirms that *there is* no *adverse impact to a design function and therefore provides the basis for screening the change out of 10CFR50.59.* A licensee's equivalency evaluation may be used as an alternate screening tool. Please see the Addendum on page ix for cautions pertaining to this information.
4. Indicates that the requirement shown is applicable only to SSCs within the scope of 10CFR50 Appendix B.
5. Utilities are required to maintain controls for changes to design output documents commensurate with those applied to the original documents. These changes to controlled design documents are required to comply with Section 7 of ANSI N45.2.11 as defined by the site document control procedures.
6. Equivalent changes to SSCs under the 10CFR50 Appendix B program should receive an independent review that will verify that the evaluation/determination correctly concludes that there is no adverse impact on the design basis function of the SSC or interfacing SSCs. This review should also verify the technical adequacy of the equivalent change. An independent design verification, in accordance with Section 6 of ANSI N45.2.11, is not required for equivalent changes.

Other requirements contained in utility engineering change programs are either discretionary or have been mandated by the NRC on a specific facility license basis.

The utility is required to maintain the commitments that constitute the current licensing basis of the facility. Reviews of certain programs may be necessary to ensure that implemented changes do not adversely impact these commitments. However, NRC regulations do not establish detailed requirements for the context of these reviews. Utilities have substantial flexibility in establishing the form, content, and structure of reviews used to ensure that program commitments are maintained. An example of a typical program review area is fire protection. All nuclear plants are committed to meeting fire protection requirements. Most utilities require a review of changes that could affect those fire protection program commitments to ensure that existing commitments are maintained. Other typical programmatic review areas include equipment qualification, ALARA commitments, and so on. This topic is addressed in Section 4.

4 ENGINEERING CHANGE PROCESS AND GUIDELINES

This section of the guideline describes the process recommended to implement various types of engineering changes encountered in support of nuclear power plant operation.

First, the overall engineering change process is described to put in perspective the different types, as well as the content, of engineering changes. The overall process and the associated individual processes are described using simplified process flowcharts. This methodology, with appropriate narrative, facilitates understanding of the process sequence, the important decision points, and where applicable, screening criteria. These flowcharts are referred to frequently in the remainder of this document.

After the description of the overall change process, the use of scoping and engineering review screens is explained. These screens, or decision aids, are the primary tools in developing the actual content and target areas for specific technical, programmatic, and regulatory-based review activities performed during the development of each type of engineering change. They also play a key role in optimization, allowing the responsible engineer to determine the appropriate level of effort and review required for a given change. By use of the screens, an engineering change may require minimal effort and reviews for a very minor change and incrementally increased effort as complexity dictates, up to a comprehensive effort for a major change. The specific content and use of the screens is presented in Sections 4.2 and 4.3.

Following the description of the overall change process and the screens, each detailed change process is described. These processes are also flowchart based and are the fundamental building blocks for the overall process. These building blocks, when coupled with effective use of the screens, provide a benchmark to evaluate a licensee's engineering change process. In doing so, areas of the process that can be improved are highlighted.

Definitions are important to the understanding of this guideline, and Section 2 should be consulted frequently to aid in understanding the topics that follow.

4.1 Overall Engineering Change Process Description

4.1.1 General Guidance

The need for, and ultimate form of, an engineering change originates in numerous places. In addition, the urgency or priority for processing the change varies substantially. For the purpose of this document, these two important factors are assumed to have been predetermined. First, the need for the development of an engineering change has already been established, and second, its priority or importance has been determined outside this process.

The first step in the engineering change process is to apply criteria that efficiently categorize engineering changes into logical groups. As shown on Figure 4-1, the types of engineering changes are as follows:

- Changes that are outside of the population of CPE
- Administrative document-only changes to CPE
- Equivalent changes affecting CPE (includes both hardware and document-only changes)
- Design changes affecting CPE (includes both hardware and document-only changes)

Figure 4-1 and the flowcharts used to describe the individual change categories that follow were developed to provide an overview of the process. They do not focus on specific details of individual steps within the process.

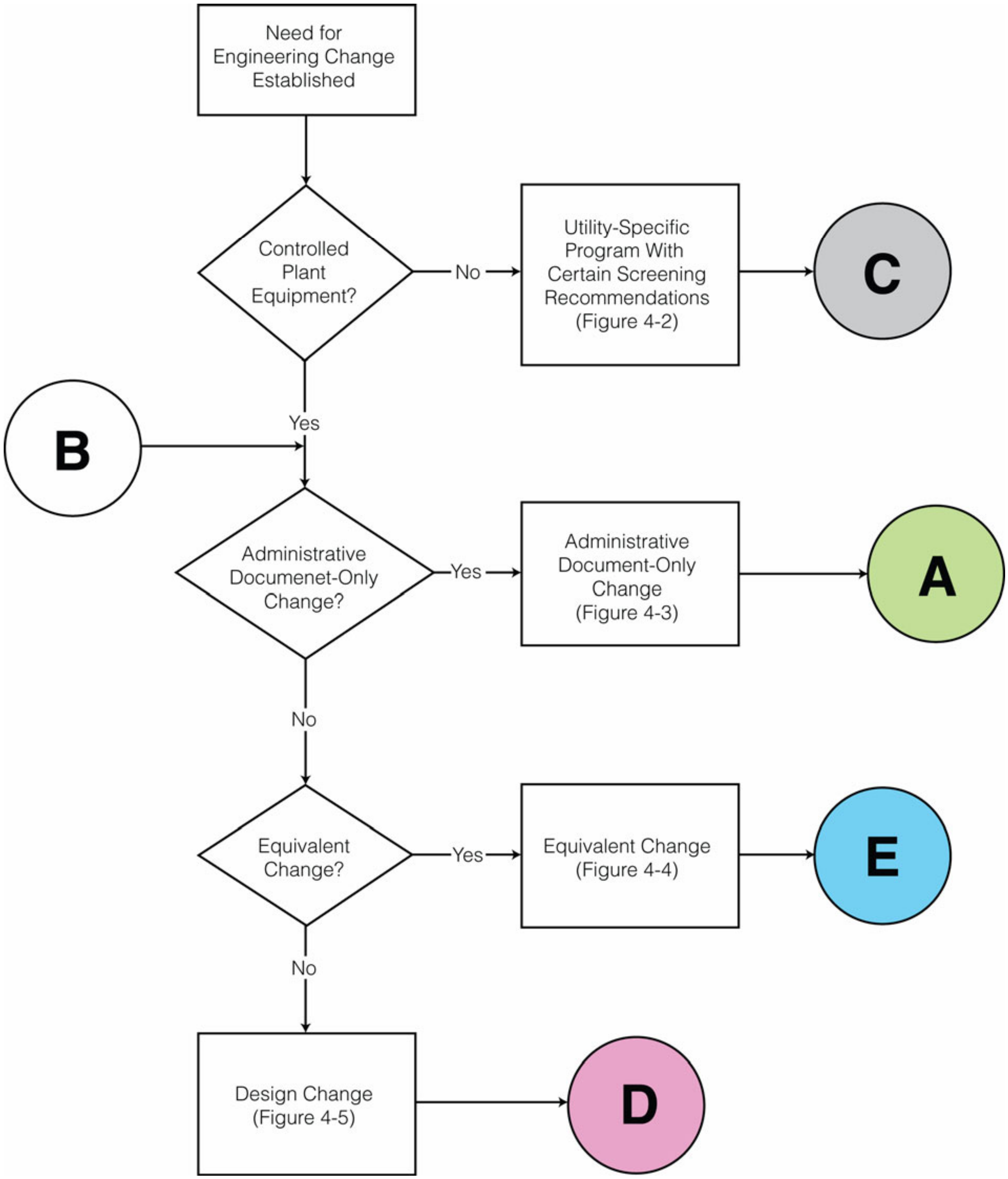


Figure 4-1
Overall Engineering Change Process

4.1.2 Identification of CPE

When the need for change is identified, a major jurisdictional decision is made. Specifically, will the change affect CPE? *CPE* is defined in Section 2 as follows:

> Structures, systems, and components that
>
> - are safety related, or
> - whose functions impact safety analysis, or
> - other structures, systems, and components that are subject to special consideration based upon management discretion (for example, considerations given to licensing basis, the Maintenance Rule, personnel safety, availability, commercial risk, etc.).

The first bullet of this definition captures systems, structures, and components that are subject to 10CFR50 Appendix B. Use of the term "safety-related" implicitly assumes that determinations of which systems, structures, and components are safety-related would be made in a manner consistent with the guidance provided in EPRI report NP-6895, *Guidelines for the Safety Classification of Systems, Components, and Parts Used in Nuclear Power Plant Applications*. This previous EPRI report provided a methodology for classifying nuclear plant systems, components, and parts using a function-based, top-down approach, which included considerations of isolation and separation of safety-related systems and components from non-safety-related systems and components, and classified those items required to ensure proper isolation as safety-related.

The second bullet of this definition is intended to capture structures, systems, and components that are not safety-related and thus are not subject to 10CFR50 Appendix B but which, if changed, can affect the plant safety analysis. Inclusion of these SSCs in the CPE list is necessary to ensure that all engineering changes that can alter assumptions made in the plant accident analyses or potentially change the probability of occurrence of a design basis accident are processed under the nuclear program. One example of this type of equipment is the main feedwater pumps, which are typically not safety-related (not required to prevent or mitigate an accident). However, analysis of certain plant events (excess feedwater, main steam line break, loss of feedwater) might include assumptions regarding flow rates and perhaps coast-down rates for these pumps. Also, the frequency of failure of a feedwater pump might factor into the loss of feedwater transient analysis. Therefore, a change that would affect these parameters could have an impact on the plant safety analysis. Non-safety-related equipment that impacts the frequency of occurrence of events analyzed in the plant safety analysis, or whose functions are modeled as bounding assumptions in the plant safety analysis, should be classified as CPE.

The third bullet provides flexibility for utilities to include SSCs subject to other requirements that management judges to be of high enough importance to merit treatment as CPE. Examples of other program requirements that may result in addition of SSCs to the CPE list include non-safety-related SSCs that are significant from any of the following perspectives:

- Maintenance rule
- Probabilistic safety assessment
- Power production (availability and capacity factor)

As defined, the population of equipment that would be classified as CPE includes all safety-related SSCs, and thus all SSCs to which 10CFR50 Appendix B, ANSI N45.2.11, and ANSI N18.7 apply. Therefore, these program controls do not need to be applied to SSCs outside of CPE.

Additional screens are applied for changes to non-CPE to determine whether other nuclear programs or regulations might be affected. Utilities may choose to use alternate definitions of CPE, which include SSCs covered by these alternate programs on the CPE list.

After the utility identifies the criteria to be used to discriminate between CPE and non-CPE, several options exist for how to fit this determination into the engineering change process:

- A utility may elect to perform a programmatic review of all plant SSCs against the selected criteria and develop a list of CPE—or conversely, a list of non-CPE—as a stand-alone project. This list would then be referred to at the appropriate point in the engineering change process to determine whether the scope of any given change affects CPE. Section A.1 provides an example of a programmatic approach to designating CPE.
- A second option is to perform individual determinations of whether the specific SSCs affected by a given change meet the criteria for CPE or are outside of CPE. If this option is selected, the utility engineering change process should incorporate the necessary selection criteria for performing the CPE/non-CPE determination on a case-by-case basis. Section A.2 provides an example of designating CPE in this manner.
- A third option would be a hybrid of the first two, with a list of CPE (or non-CPE) SSCs being built as case-by-case evaluations are completed. In this option, the utility process would both refer to the existing list to determine whether the SSCs affected by the change had been previously evaluated and also include the evaluation criteria for cases where the SSCs affected by the change have not been previously evaluated.

It is essential that the engineering change program controls applied to non-CPE by the utility be consistent with the final definition used by the utility for selection of CPE.

It is clear from the definition that the population of CPE will vary among utilities depending on a number of factors. Each utility should also recognize that there are some facilities that are not controlled in any manner by the engineering change process and are not subject to any licensing requirements. However, some basic examples of items that should clearly be outside CPE include the following:

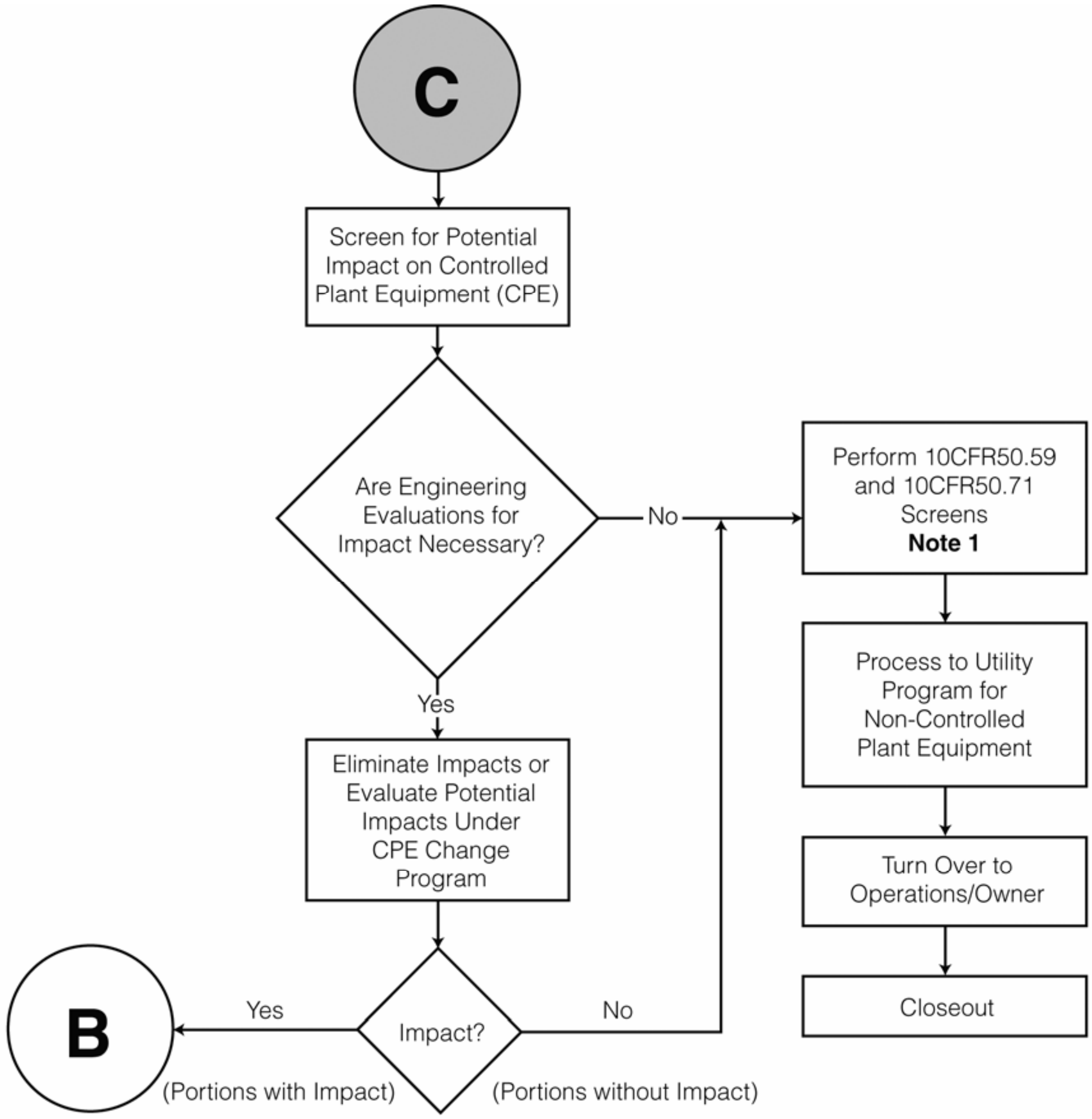
- A maintenance warehouse within the security perimeter
- Heating, ventilation, and cooling systems associated with the on-site administration building
- A parking lot within the security perimeter

Other plant structures, systems, and components that are not as clearly categorized as outside CPE include the following:

- Main transformer
- A site computer local area network (LAN) or wide area network (WAN)
- The site communications system

4.1.3 Commercial Controls Program for Non-CPE

If the change falls outside CPE, it is implemented under the utility's commercial controls program. This process is shown in Figure 4-2 and is further described in Section 4.4. Use of a commercial controls program eliminates many of the technical and administrative steps that would otherwise be included in changes within the nuclear jurisdiction. Specific utility commercial controls programs vary due to state and local regulations, among other things, but common factors include compliance to applicable regulations (for example, OSHA, building codes, and environmental regulations), application of appropriate codes and standards, and use of good engineering practices.



Note 1: These screens may be performed at any time based upon each utility's plant-specific procedures.

Figure 4-2
Changes to Non-CPE

4.1.4 Administrative Document-Only Changes

The next major decision determines whether the change can be classified as an administrative document-only change. Inconsequential activities that do not affect the design function or method of performing the design function of an SSC do not require 10CFR50.59 evaluations. Activities in this category may result in modifications to the UFSAR or other design outputs that are editorial, clarifications with no change in the described system function, information already directly approved by the NRC, correcting inconsistencies in the UFSAR, and minor corrections to drawings. Such activities involving the UFSAR must therefore be included in UFSAR updates required by 10CFR50.71. Administrative document-only changes follow the process shown in Figure 4-3 and described in Section 4.5.

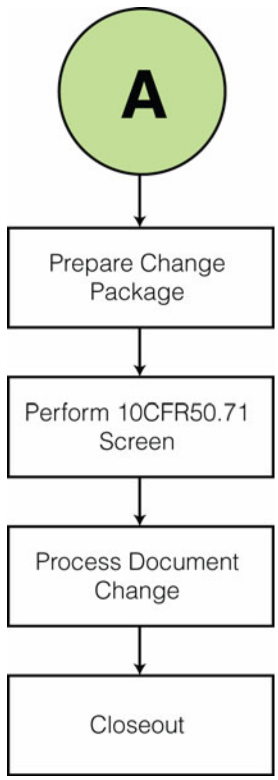


Figure 4-3
Administrative Document-Only Changes

4.1.5 Equivalent Changes

The changes that filter through the first two decision points consist of technical changes that affect CPE. Further decision points shown in Figure 4-1 determine whether the change can be processed as an equivalent change. Equivalent changes maintain the intended design and licensing bases of the affected items but might result in a different configuration than the current installation. Equivalent changes might result in both hardware changes and document-only changes that **do not** affect the bounded technical requirements in existing plant documents. In order to accomplish this, the evaluation must demonstrate that equivalent changes do not adversely impact the design function or the method of performing the design function of any system, structure, or component. The process for equivalent changes is shown in Figure 4-4 and described in Section 4.6.

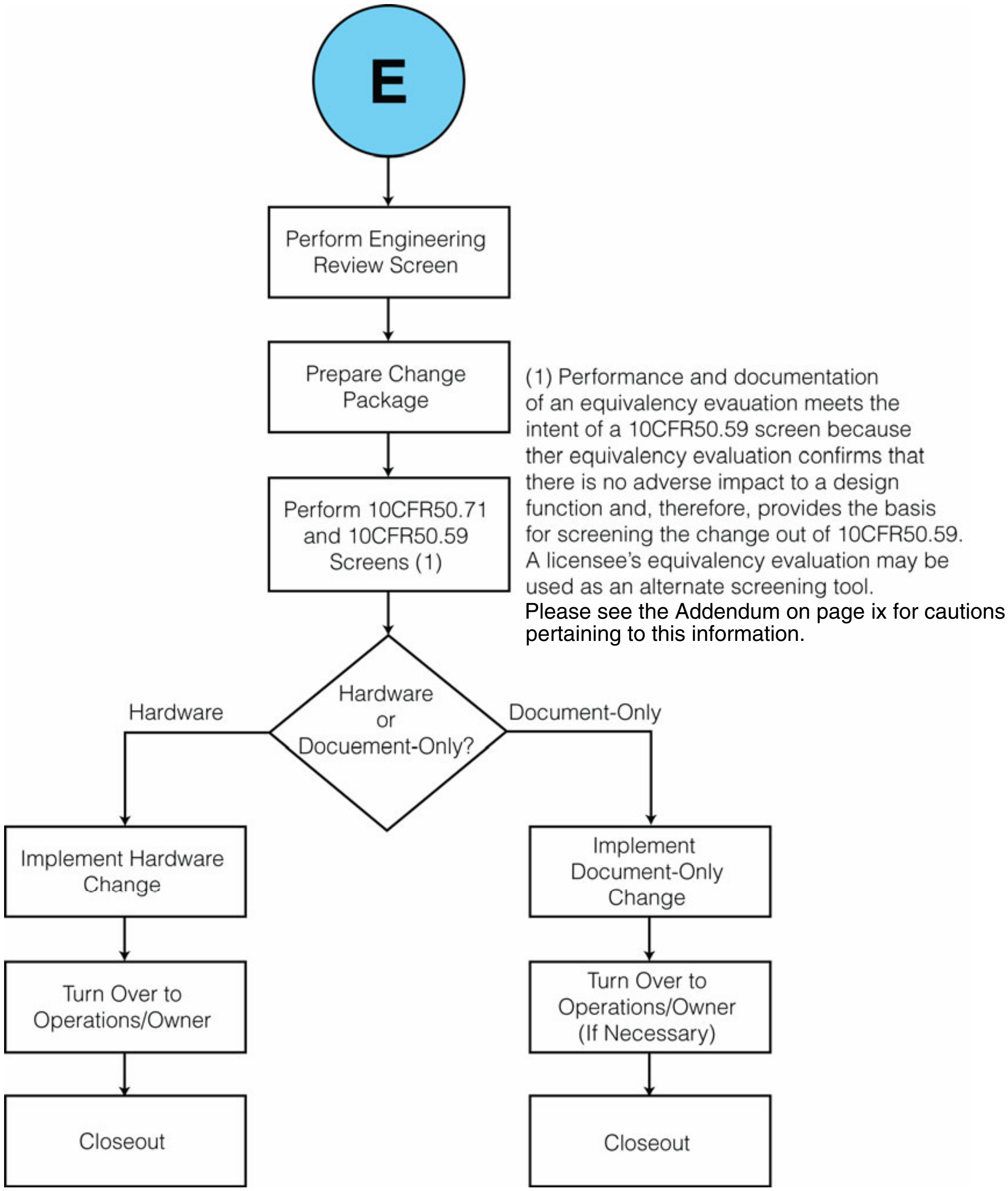


Figure 4-4
Equivalent Change to CPE

4.1.6 Design Changes

The remaining changes consist of design changes to CPE. Design changes might result in both hardware changes and document-only changes that **do** affect the bounded technical requirements in existing plant documents. The process for design changes is shown in Figure 4-5 and described in Section 4.7.

Figure 4-5
Design Change to CPE

4.1.7 Summary

The primary purpose for creating the overall engineering change process flowchart is to demonstrate a method of categorizing engineering changes; that is, screening changes efficiently into processes devised to optimize their implementation and away from processes that unnecessarily require more technical and administrative content. A composite of Figures 4-1 through 4-5 is shown in Figure 4-6.

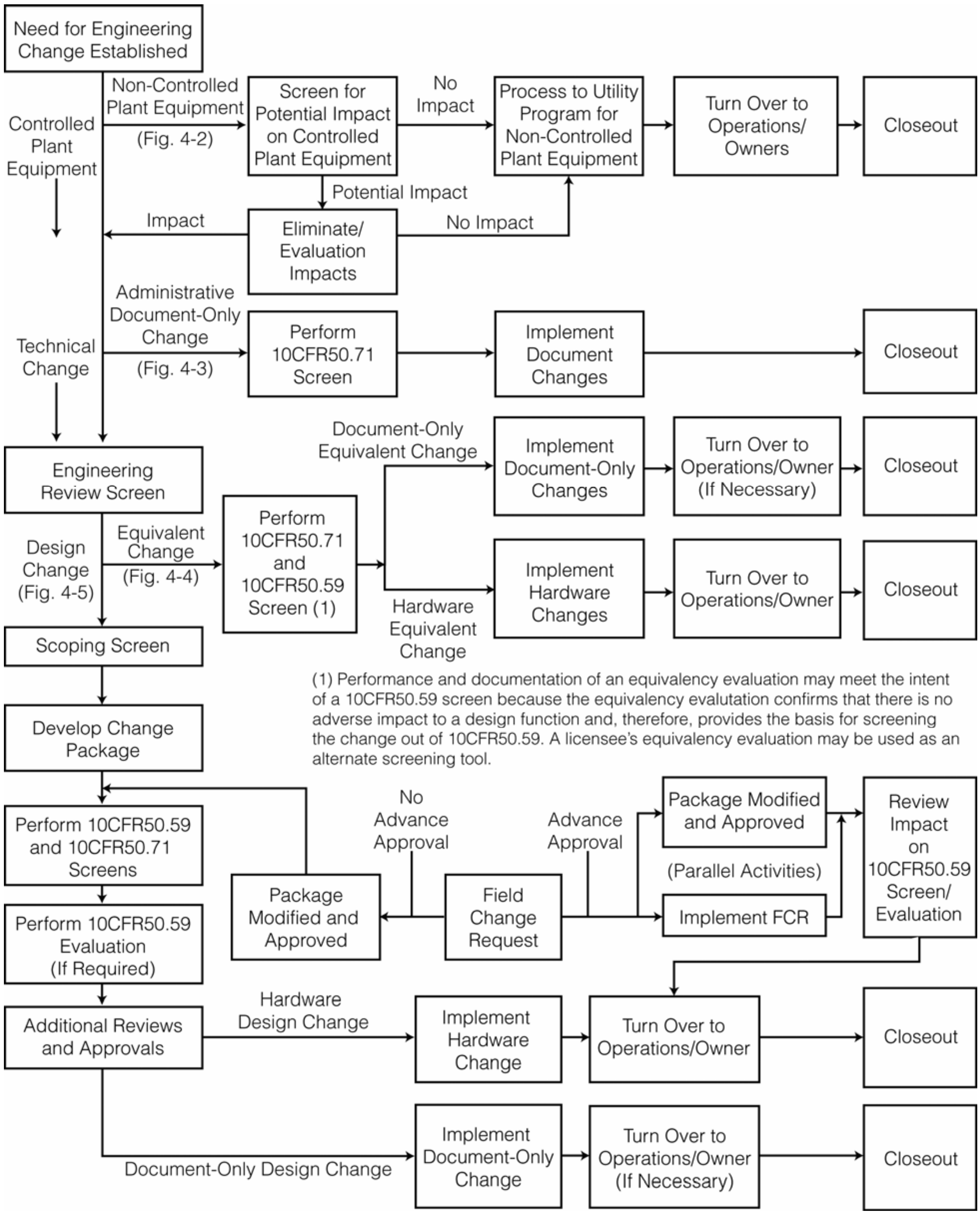


Figure 4-6
Composite Flowchart

Prior to more detailed description of the individual change processes, Sections 4.2 and 4.3 describe the scoping and engineering review screens. These screens are fundamental tools that aid in ensuring that a given change is processed with the appropriate types of reviews.

Section 4.1 Summary Recommendations

1. Utilities should establish clear boundaries for structures, systems, and components (SSCs) within the definition of CPE. Engineering changes made to SSCs outside of CPE should be implemented under the utility's commercial program.
2. Within the jurisdiction of CPE, there should be a hierarchy of changes. This hierarchy has two parameters: (1) the type of change (for example, administrative document-only, equivalent, design), and (2) the level of design control (design input, design preparation, design output, and reviews and approvals).
3. The change programs should be structured in such a way that screening of the least manpower-intensive changes is accomplished early in the process. This approach ensures that as little engineering effort as possible will be wasted in screening and reviews. Figure 4-1 describes a process that accomplishes this in an effective manner.

4.2 Use of 10CFR50.59 and 10CFR50.71 Screens

Two screens are recommended to address specific regulatory requirements associated with the implementation of engineering changes. These screens are fundamentally different from the decision screens described in the following section. Their purpose is to ensure that requirements of 10CFR50.59 and 10CFR50.71 are properly addressed for each type of engineering change. The purpose of the decision screens presented in Section 4.3 is to ensure that resources are efficiently applied to each change processed and that unnecessary or no-value-added activities are avoided.

4.2.1 10CFR50.59 Applicability and Screening

4.2.1.1 Applicability of the 10CFR50.59 Screen

When implementing a change, it is important to determine the impact on the plant-specific current licensing bases, which may include the licensee's UFSAR, operating license and technical specifications, NRC regulations, and other docketed commitments. 10CFR50.59 focuses on the effects of an activity on the UFSAR safety analysis. NEI 97-06 Revision 1 requires the first step in this action to be the 10CFR50.59 applicability determination, which is implemented to reduce duplication and ensure that changes are processed under the appropriate change process. The 10CFR50.59 applicability determination should identify those elements of the change that should be processed under more specific change processes and those that should be processed under 10CFR50.59.

4.2.1.2 10CFR50.59 Screen

Many engineering changes (with the exception of inconsequential administrative changes) must be reviewed against 10CFR50.59. The result of the 10CFR50.59 screen is a determination of whether or not the change requires a full 10CFR50.59 evaluation.

In each case, the 10CFR50.59 screen is performed following development of the change package. The screen enables the licensee to evaluate impacts of the change on design function(s) of plant systems, structures, and components, and on related design bases and licensing bases.

For changes outside of CPE, it is expected that the result of the screen would be to confirm that no written 10CFR50.59 evaluation is required. If changes have been properly categorized according to the definitions included in this guideline, changes of this type should not meet criteria that would require a written 10CFR50.59 evaluation. Retention of the screening evaluation documentation that confirms this decision is recommended, to a degree commensurate with the safety significance of the change. Typically the screening documentation is retained as part of the change package.

It is anticipated that some design changes will meet criteria that require preparation of a formal, written 10CFR50.59 evaluation. According to NEI 96-07 Revision 1, screening records need not be retained for activities for which a 10CFR50.59 evaluation was performed or for activities that were never implemented.

4.2.2 10CFR50.71 Screen

10CFR50.71 requires that the descriptive information provided in the UFSAR be kept current through a regular update process. Any change that alters or makes obsolete any of the information provided in the UFSAR must be identified, and appropriate action must taken to ensure that necessary changes to the UFSAR are included in the next update cycle. For this reason, a 10CFR50.71 screen is included on the flowchart for each type of engineering change, even administrative document-only changes.

10CFR50.71 does not include any specific documentation requirements other than ensuring that the UFSAR is maintained current and correct. Therefore, the 10CFR50.71 screen need not be written and captured as a record to meet regulatory requirements. The format and record retention policy for 10CFR50.71 screens is left to the discretion of the utility.

4.3 Use of Decision Screens

During the descriptions of individual change processes that follow, the use of decision screens is recommended. These screens help to determine the administrative content of a change package, the specific programmatic reviews required in a particular subject area, and the reviews required by NRC regulations and other requirements.

The screens provide decision-making criteria and are not recommended as additional checklists. In fact, checklists currently in use should be carefully reviewed, and possibly reorganized, so that the screens described in the following subsections can result in elimination of groups of questions from consideration for a given change when one or two questions indicate no relevance for these questions. In addition, items have entered into the checklists currently being used that are not required and are not relevant for safety, quality, programmatic, or performance considerations. These checklist questions should be reviewed for possible deletion.

This guideline recommends use of two types of decision screens—the engineering change scoping screen and the engineering review screen. These screens and their general use are presented in the following subsections. Both their specific use and the appropriate sequencing of their use are addressed in each individual change process description.

4.3.1 Engineering Change Scoping Screen

The purpose of the engineering change scoping screen is to aid in determining what value-added reports, actions, and interface reviews should be performed for a given engineering change and likewise, what unneeded reports, actions, and reviews should be eliminated. Unlike the engineering review screens described in Section 4.3.2, the scoping screen is designed to optimize the organizational and programmatic aspects of a given engineering change. It can be used to define the contents of the engineering change package.

The scoping screen can be applied when both hardware changes and document-only changes result. Screening of document-only changes is of the most value for large changes, such as comprehensive changes to procedures, databases, or calculations. The screen covers the extent to which non-mandatory reports, actions, and reviews need to be included in a given change package. This screen also helps engineers determine the extent to which a number of good practices should be applied.

The scoping screen consists of seven question areas that aid in determining whether (1) a conceptual design, an alternate solutions report, or other administrative reports are necessary; (2) other engineering discipline reviews are warranted; and (3) certain field walkdowns are required. Table 4-1 describes the seven question areas.

Table 4-1
Engineering Change Scoping Screen

Engineering Change Scoping Screen	
1.	Are there potentially multiple solutions to the problem that precipitated the modification and therefore would an alternate solutions report be beneficial?
2.	Does the engineering change involve significant design or analysis, indicating that a conceptual design would be beneficial?
3.	Does the change involve multiple engineering disciplines, indicating that an interdisciplinary review would be beneficial?
4.	Does the change result in one or more of the following? • Installation in restricted or congested areas • Use of multiple construction techniques • The addition of maintenance intensive equipment If so, a constructability and maintainability review, including appropriate field walkdowns, may be beneficial.
5.	Does the change require coordination among various organizational elements such that design responsibility and lines of communication need to be established with the aid of a project plan?
6.	Does the change have a plant operational impact wherein an operations review during design development would be beneficial?
7.	Are there any preliminary QA or QC requirements associated with the change and therefore should a QA or QC review be completed during design development?

Positive responses to these screening criteria indicate that certain reviews should be undertaken and documented. Such reviews are performed and documented in accordance with each utility's program and procedures. Use of additional screening criteria, supplemental screening tools, or other review aids is left to the discretion of each utility.

The screening criteria provided in Table 4-1 and in other tables in this report are not intended to be the actual questions that would be used in the detailed screening performed by utilities. Rather, these tables provide guidance as to the areas that should be addressed by the utility's screening process. Development of technically rigorous screening criteria appropriate for each area is the responsibility of the utility implementing this guidance.

4.3.2 Engineering Review Screens

Two engineering review screens are used in the recommended engineering change process. The first engineering review screen (see Table 4-2) addresses changes outside of CPE. The second engineering review screen (see Table 4-3) addresses changes that affect CPE.

Similar to the scoping screen, these engineering review screens aid in determining what programmatic engineering reviews and resultant additional efforts are necessary for a given engineering change. In addition, the screens eliminate minimal-impact or no-value-added engineering reviews.

The engineering reviews identified should be processed and documented in accordance with a given utility's specific procedures. Supplementary screening tools or other forms of guidance should also be used as necessary.

4.3.2.1 Engineering Review Screens for Changes Outside CPE

This screen ensures that the engineering change is evaluated for any adverse impact to CPE. Interface impact questions focus on electrical distribution, fire protection, security, and other auxiliary support systems. Three opportunities exist to eliminate potentially adverse impacts: (1) change the design so that the potential impact no longer exists, (2) analyze to justify that no adverse impact exists, or (3) process the portions of the change with potential adverse impact through the CPE change program.

Table 4-2
Engineering Review Screen for Changes Outside CPE

Engineering Review Screen for Changes Outside CPE	
1.	Does the change have interfaces with the potential to adversely impact any systems within CPE including electrical power distribution systems, HVAC, pneumatic systems, instrumentation systems or cooling water systems?
2.	Does the change have interfaces with the potential to adversely impact existing fire suppression/detection systems?
3.	Does the change introduce new or unanalyzed combustibles that may impact previous fire hazard analysis?
4.	Does the change introduce any new or unanalyzed toxic gases or other hazardous substances that would require a hazardous chemical evaluation or have the potential to impact the control room habitability review?
5.	Does the change have the potential to impact the ability to safely shut down and control the plant following a fire as analyzed in the Appendix R safe shutdown analysis?
6.	Does the change have the potential to impact the environmental qualification of any plant equipment?
7.	Does the change have the potential to create a line break that could have adverse consequences?

Table 4-2 (continued)
Engineering Review Screen for Changes Outside CPE

8.	Does the change have the potential to impact any protection feature credited in the plant analyses of the impact of potential missiles, or does the change introduce the possibility of new missiles not previously analyzed?
9.	Does the change have the potential to impact the plant masonry block walls analysis, or impact any design feature credited in that analysis with preventing or mitigating damage due to such failures?
10.	Does the change have the potential to impact the physical security plan?
11.	Does the change have the potential to impact previous site drainage or external flooding analysis?
12.	Could the change affect conclusions reached in the UFSAR about the design function or the method of performing the function of a structure, system, or component described in the UFSAR?
13.	Does the change have the potential to adversely impact the emergency plan?
14.	Does the change have the potential to create seismic interactions with CPE?

4.3.2.2 Engineering Review Screens for Changes Within CPE

This screen is the discriminating tool used to determine which regulatory-based and individual programmatic reviews are required for any given change.

The screening questions determine the following:

- The need for additional engineering review to ensure that program commitments that, in part, form the plant's current licensing basis are maintained. Such program commitments may include fire protection, equipment qualification, system interaction, separation, control room habitability, and so on.
- The need to perform and document an independent design verification in accordance with ANSI N45.2.11.
- The need to document, review, and approve design input in accordance with ANSI N45.2.11.

In determining which programmatic reviews are required, the responsible engineer should be careful to ensure that peripheral issues whose impact is not obvious are addressed. For instance, when considering control room habitability, the installation of a change requiring a new control room block out/penetration creates an interim breach that may adversely impact control room habitability. This impact should be identified by the engineering review screen and evaluated as a part of the engineering change. In Section 5 of this report, the training of personnel performing the screening is addressed.

Table 4-3
Engineering Review Screens for Changes Within CPE

Engineering Review Screen for Changes Within CPE	
1.	ALARA Impact Does the change have the potential to adversely impact personnel radiation dose?
2.	Accident Interaction Evaluation Does the change have the potential to adversely impact previous interaction analysis, including (1) high-energy line break, (2) internal flooding, (3) internal missile generation, (4) heavy load transfer, (5) or seismic interaction?
3.	Control Room Impact Evaluation Does the change have the potential to adversely impact control room human factors evaluations? Does the change have the potential to adversely impact control room habitability?
4.	Equipment Qualification Does the change have the potential to adversely impact environmental or seismic equipment qualification?
5.	External Accident Mitigation Does the change have the potential to adversely impact previously installed means of mitigating the effects of tornadoes, hurricane winds, flooding, or seismic induced loads?
6.	System Interaction Evaluation Does the change have the potential to adversely impact system interactions, such as HVAC loads, electrical distribution loads, electrical separation, instrument air capacity, pipe system pressure rating (for example, intersystem LOCA), or containment integrity?
7.	Fire Protection Analysis Does the change have the potential to adversely impact the existing fire protection safe shutdown analysis, fire loading analysis, fire detection or suppression equipment, or other administrative controls?
8.	Security Does the change have the potential to impact existing security/safeguards plans?
9.	Program Impact Review Does the change have the potential to adversely impact the following programs: (1) radwaste reduction, (2) cobalt reduction, (3) management information systems (that is, database management), (4) erosion/corrosion, (5) plant labeling or housekeeping improvement, or (6) ISI?
10.	Block Walls Does the change have the potential to impact the plant masonry block walls analysis or impact any design features credited in that analysis with preventing or mitigating damage due to block wall failures?

Table 4-3 (continued)
Engineering Review Screens for Changes Within CPE

Engineering Review Screen for Changes Within CPE	
11.	Emergency Plan Does the change have the potential to adversely impact the emergency plan?
12.	10CFR50 Appendix B Requirements Does the change fall within the scope of 10CFR50 Appendix B, as described in the current licensing basis?

Section 4.3 Summary Recommendations

1. Decision screens should be used to determine the need for certain evaluations, reviews, and/or approvals by different disciplines, and those that add little or no value should be eliminated. These screens address both scoping and engineering review issues.
2. All engineering changes should be screened to determine the need to update the UFSAR as required by 10CFR50.71.
3. All engineering changes, except administrative document-only changes, should be evaluated for their applicability to 10CFR50.59. Those applicable changes should be subsequently screened to determine whether an evaluation is required under 10CFR50.59.
4. Scoping screens should focus on the organizational and programmatic aspects of evaluating and reviewing a particular change package. They should consider the complexity and extent of changes on a change-specific basis. For example, involve procurement engineering as soon as possible when engineering changes result in modifications to SSCs. This practice minimizes the chance of inadvertently installing or stocking obsolete items.
5. Engineering review screens should be used for changes outside of CPE to ensure that the change will not adversely affect CPE.
6. Engineering review screens (different from those used for changes outside of CPE) should be used for changes to CPE to determine which programmatic reviews are necessary.
7. Existing checklists should be evaluated periodically and those items that are not relevant to the review process should be removed.
8. Checklists should be organized in a hierarchy that allows the negative response to a limited number of overview questions to eliminate the need for response to numerous detailed questions in any particular review area.

Sections B.1 and B.2 present examples of how utilities implement engineering review screens and the types of questions used to perform the screens.

4.4 Detailed Process for Changes Outside of CPE

Figure 4-2 provides the process flowchart for engineering changes outside of CPE. The definition of “outside of controlled plant equipment” is provided in Section 2, and an example showing how utilities programmatically discriminate between CPE and that outside of CPE is contained in Section A.1. Section A.2 presents an example of a screen used to identify CPE on a case-by-case basis. The specific details of the process involving changes outside of CPE are unique for each utility. However, as shown in Figure 4-2, guidance is provided on how the changes are evaluated for potential impact to CPE.

4.4.1 CPE Impact Analysis

The process initiates with a determination that the change involves structures, systems, or components primarily outside of CPE. The first task is to determine whether the potential exists for the engineering change to adversely affect CPE, the plant safety analyses, or other programmatic requirements. This determination is made using Table 4-2.

10CFR50.59 and 10CFR50.71 screens are performed and documented in accordance with utility procedures. If no potential adverse impacts are identified, the change is then processed using the commercial codes, standards, and methods deemed appropriate by each individual utility. This is referred to as implementing changes under commercial controls. Under commercial controls, the review and documentation support is not driven by nuclear requirements and is typically less burdensome. The change is implemented in an efficient, direct manner.

If the screening process indicates a potential adverse impact or the need for a 10CFR50.59 evaluation, preparation of a documented impact evaluation is recommended. If the evaluation raises new issues or substantiates that an adverse impact exists, then action is taken to resolve the issues prior to implementation under commercial controls. This action could result in a change involving CPE, which is presented in the next section.

4.4.2 CPE Tie-Ins

The proposed change may involve interfaces within or tie-ins to CPE. The engineering process related to developing the detailed design for these tie-ins needs to be addressed in accordance with the process for changes within CPE. There may be cases in which part of the engineering change is implemented under commercial controls and part under the process for changes to CPE. The interface and tie-in evaluations are conducted by personnel familiar with the utility’s nuclear program. This ensures that those aspects of the interface that may be subject to nuclear design criteria and/or the regulatory process are properly addressed and evaluated.

An example of an engineering change implemented under commercial controls, the addition of a gymnasium to an existing on-site facility, is described in Section C.1.

Section 4.4 Summary Recommendations

9. Utility personnel can and should use a great deal of discretion in specifying the required contents and reviews for changes made outside of CPE.
10. The primary determination that must be made for changes outside of CPE is that the change does not adversely affect CPE.

4.5 Detailed Process for Administrative Document-Only Changes

There are two fundamental types of document changes—those of a strictly administrative nature and those that involve technical changes to documents, such as calculations, specifications, some databases, and analyses. The calculations or analyses do not always involve a change in configuration but may be a new calculation to support an existing configuration. Also, for the purpose of this guideline, set-point changes to equipment are not considered document changes. They fall within the category of hardware changes because physical change to the response of equipment occurs.

Administrative document-only changes are either (1) formal revisions that correct discrepancies in plant documents to conform to approved plant design or (2) nontechnical changes, such as corrections to typographical errors.

Administrative changes are straightforward and inconsequential. Examples include the following:

- Bringing documents into consistency with other documents
- Clarifying illegible documents
- Correcting typographical errors
- Making editorial corrections
- Making clarifications with no change in the described system function
- Making minor corrections to drawings

Figure 4-3 provides the flowchart for processing administrative document-only changes. Document-only changes, whether administrative or technical in nature, have the potential to change information or documents provided to the NRC in the UFSAR. Therefore, 10CFR50.71(e) screening should be performed for all document-only changes, and appropriate controls should be applied to ensure update of the UFSAR as necessary.

The following decision criteria might be used to determine whether the engineering change could be considered an administrative document-only change. An administrative document-only change typically has the following attributes:

- Has no effect on the design, design function, or means of performing the function of SSCs
- Adds clarifying or descriptive information
- Does not involve hardware changes
- Corrects existing documents to conform to design requirements
- Corrects typographical errors

Section C.2 provides an example of how a utility categorized and processed an administrative document-only change.

Section 4.5 Summary Recommendations

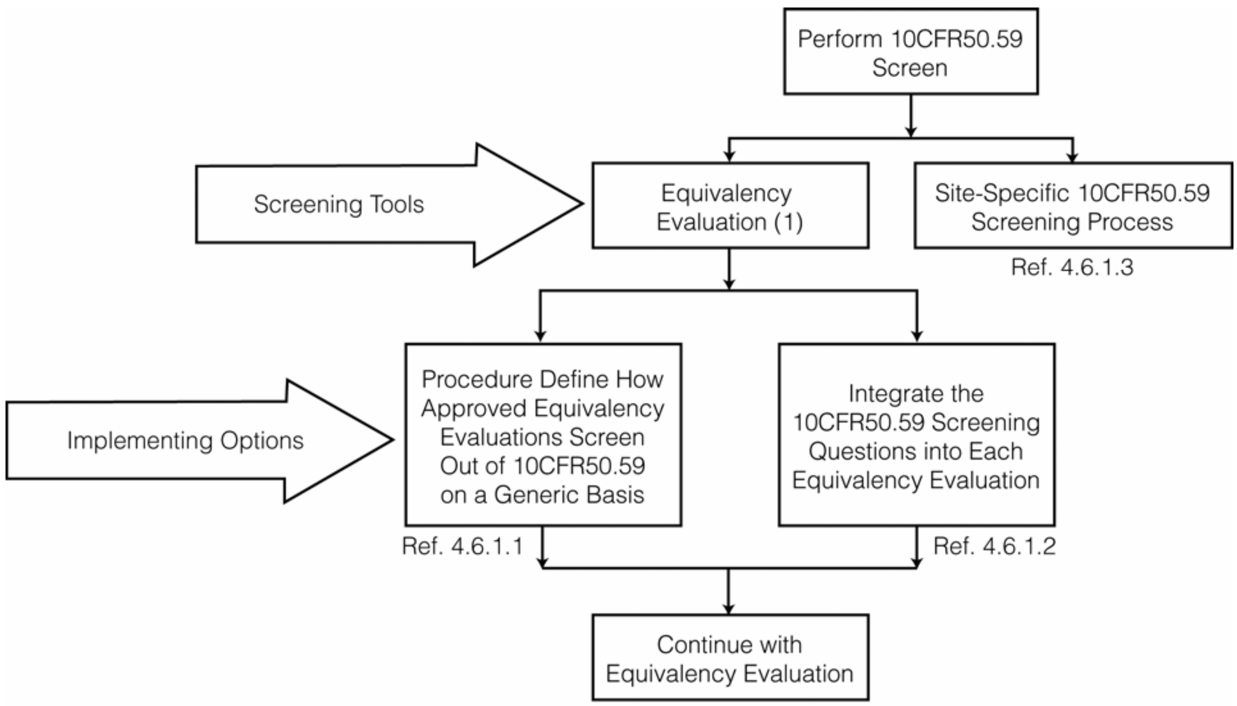
1. Administrative document-only changes are formal revisions that correct discrepancies in plant documents to conform to approved plant design or are non-technical changes, such as corrections to typographical errors.
2. Document-only changes, whether administrative or technical in nature, have the potential to change information or documents provided to the NRC in the UFSAR. Therefore, 10CFR50.71(e) screening should be performed for all document-only changes, and appropriate controls should be applied to ensure update of the UFSAR as necessary.

4.6 Detailed Process for Equivalent Changes

Refer to Figure 4-4, which provides the process flowchart for the equivalent change segment of the overall engineering change process. Effective and innovative use of this process is one of the key tools in improving the engineering change process.

4.6.1 Screening Tools for Equivalent Changes

Figure 4-7 illustrates that there are two tools available for screening equivalent changes that meet the intent of 10CFR50.59. Those two tools are the equivalency evaluation itself and the 10CFR50.59 screen already described in site-specific procedures. Figure 4-7 also illustrates that if the equivalency evaluation is selected as the tool for screening, then the screen can be done on either a generic basis or on a case-by-case basis.



(1) Performance and documentation of an equivalency evaluation may meet the intent of a 10CFR50.59 screen because the equivalency evalutation confirms that there is no adverse impact to a design function and, therefore, provides the basis for screening the change out of 10CFR50.59. A licensee's equivalency evaluation may be used as an alternate screening tool.

Figure 4-7
Screening Tools for Equivalent Changes

4.6.1.1 Procedurally Define How Approved Equivalency Evaluations Screen Out of 10CFR50.59 on a Generic Basis

One approach to meeting the requirements of 10CFR50.59 for ensuring that equivalent changes are appropriately reviewed for potential license amendments is to take procedural steps to generically define the basis for screening these items out of 10CFR50.59. Equivalent changes are defined in NEI 96-07 Revision 1 as those items that do **not** alter the design functions of SSCs. Therefore, one method of meeting the intent of the regulation is to procedurally establish that an item, when it has been determined to be an equivalent replacement, has not altered the design function of the item or component. By being an equivalent change, it screens out of the 10CFR50.59 process, and this method generically screens those items that have been evaluated as equivalent replacements from the 10CFR50.59 process.

4.6.1.2 Integrate the 10CFR50.59 Screening Questions into Each Equivalency Evaluation

A second approach to ensure that the equivalency evaluation provides the basis for screening an item out of 10CFR50.59 is to incorporate 10CFR50.59 screening questions into each equivalency evaluation. Integrating the screening questions into each equivalency evaluation ensures that the intent of the screen is met and that the basis for screening out of the 10CFR50.59 process is documented. Because the 10CFR50.59 screen in integrated into each equivalency evaluation, duplicating the process with a separate screening form is not required.

4.6.1.3 Site-Specific 10CFR50.59 Screening Process

Another way of ensuring that the equivalency evaluation meets the requirements of the 10CFR50.59 process is to perform the screen in accordance with existing site-specific procedures and associate the results with each equivalency evaluation. The screening questions should procedurally confirm that the item does not require a 10CFR50.59 evaluation if the item is in fact an equivalent replacement.

Each of the three implementation options provides the licensee a means to meet the intent of the 10CFR50.59 screen as the process relates to equivalent engineering changes.

4.6.2 Equivalent Change Scope

Before describing the process, it is important to understand the definition and scope of the equivalent change as used in this guideline. *Equivalent change* is defined in Section 2 as follows:

> A change that does **not** result in an adverse change to those bounded technical requirements that (1) ensure performance of design basis functions or (2) ensure compliance with the plant licensing bases of either the item(s) or applicable interfaces.

Equivalent changes might involve physical changes to plant hardware or might involve only changes to plant documents. Both types of equivalent changes are described in the following subsections.

4.6.2.1 Equivalent Hardware Change

The level of detail of the equivalency evaluation must be sufficient to ensure that the proposed engineering change does not result in an adverse change to any of the bounded technical requirements for a system, structure, or component, directly or indirectly. The evaluation must verify that the change does not adversely affect the design function or the method of performing the design function of a system, structure, or component. For evaluation of simple items, such as an alternate small manual valve, the evaluation might be straightforward. For other replacements, such as installation of an alternate large motor, a significant engineering evaluation might be needed to ensure that the replacement item is equivalent.

As a minimum, the evaluation performed to determine that a replacement item is equivalent must consider the following for NEI 96-07:

- Does the change add or delete an automatic or manual feature of the SSC?
- Does the change convert a feature that was automatic to manual or vice versa?
- Does the change introduce an unwanted or previously unreviewed system interaction?
- Does the change alter the seismic or environmental qualification of the SSC?
- Does the change affect the quality group classification of the SSC?
- If the change is the replacement of a component, are the operating characteristics of the new equipment equivalent to those of the old component? Specifically:
  - For instruments, are the response time, range, and design pressure and temperature equivalent to that of the old instrument?
  - For pumps, are the flow/head characteristics, design temperature and pressure, motor size, and controls equivalent to that of the old pump?
  - For valves, are the operating time, failure position, size, design temperature and pressure, valve operators, and controls equivalent to those of the old valve?
  - For piping, are the material, design temperature and pressure, supports, insulation, and routing equivalent to that of the old piping?
  - For fuel, are the fission product barriers and operating characteristics enveloped by previous analyses?
  - Does the change impact other systems?
  - For new electrical loads, will the diesel generator loading sequence be changed or affected? Will the total load be within the design capability of the diesel generator?
- Does the change affect other units at a multiple-unit site?

The following are examples of equivalent hardware changes:

- Replacing a safety-related manual valve with one manufactured by a different company that meets the technical requirements included in the utility’s applicable valve specification for materials, pressure class, design codes, and flow characteristics, and whose weight is within the range allowed by the current seismic analysis for the piping system.
- Replacing a skid-mounted HVAC compressor unit with one from a different vendor. A mounting analysis is necessary to ensure that the new compressor, with a different weight, does not invalidate existing calculations and/or qualifications associated with the skid package. All other functional parameters meet performance-related technical requirements of existing specifications and interfacing systems and components. Seismic and EQ qualification status is also maintained by the replacement.
- Replacing one lubricant with another that is functionally equivalent, through evaluation of critical characteristics for design (such as temperature rating, materials compatibility, and radiation level qualification).

- Changing instrument manufacturers where the replacement meets all requirements of existing specifications and other design documents and interfaces correctly with associated equipment.
- Replacing flange fittings with compression-type fittings on a pump unit. Analysis is necessary to ensure that the new configuration does not invalidate existing calculations and/or qualifications associated with the pump.
- Changing a gate valve to a globe valve, assuming that the applicable design specification allows either type of valve to be used and that the new valve Cv (Valve Coefficient), materials, pressure class, and design codes meet specification and licensing basis requirements. The valve weight also must be within existing analysis tolerances.
- Changing set points that do not affect bounded technical requirements.

Referring to the definition of an equivalent change, the following changes could not be performed as equivalent hardware changes:

- Adding a new platform to the plant
- Adding a drain/vent/test connection for a new function

The new platform is not equivalent because it might have its own design basis function and very likely will affect the design function of interfacing systems. The drain/vent/test connection is not equivalent because its design bases will have to be established.

4.6.2.2 Equivalent Document-Only Changes

Changes to existing plant documents that do not modify bounded technical requirements for CPE might also be processed as equivalent changes. Examples of equivalent document-only changes include the following:

- Modifying an existing valve specification to change the stroke time requirements, where valve closure or opening is not a design basis safety function nor related to any licensing commitment
- Evaluating a new hazard that does not impact bounded technical requirements and does not result in a hardware change
- Updating specifications when no design basis information is changed
- Revising controlled electronic data, such as Q-list information, when no bounded technical requirements are changed
- Documenting a part-number change for an identical or equivalent replacement item
- Resolving a use-as-is evaluation for a nonconforming item
- Resolving an as-built condition that results in a change to a drawing but not a change to an SSC

4.6.3 Engineering Review Screen

Following completion of the appropriate scoping reviews and incorporation of appropriate engineering inputs, the change package is subjected to the engineering review screen described in Table 4-3. At this point, the need for specific detailed programmatic engineering reviews and independent review is determined, and the reviews are performed as necessary.

Although not explicitly shown in Figure 4-5, it is anticipated that changes to the original conceptual design, problem solutions, and detailed design may be necessary to resolve problems identified by the various engineering reviews. In addition, each utility should determine to what extent the review documentation needs to be a part of the overall change package. As the change process commences, preliminary closeout support activities should be considered. (See Section 4.9 of this report.)

4.6.4 Processing Equivalent Changes

The use and benefit of the equivalent change process rests on the outcome of the equivalent change evaluation. Two options are available for performing the necessary determination of whether the change is equivalent. The selection of which option to use is based on whether the licensing basis and design basis requirements are available or are held by organizations other than the utility, as follows:

- If the appropriate documents that define the applicable licensing basis and design basis requirements **are** available, a determination can be made as to whether the change meets the bounding technical requirements related to design basis functions and the plant licensing basis. Typically, documents that define the licensing and design basis requirements at the system and component level are available in the utility's records. Screening criteria can be used to ensure that all potential programs (for example, 10CFR50.59, EQ, fire protection, and seismic) are properly considered.
- If the documents that define the applicable licensing basis and design basis requirements are **not** available but are controlled by others, such as the equipment vendor (as is often the case for subcomponents or parts), the process described in EPRI report NP-6406 can be used to determine critical characteristics for design of the item and to complete the necessary equivalency evaluation.

The details as to extent, methodology, and documentation of that evaluation are determined by each individual utility. If the result of the evaluation is affirmative, the process involves implementing the change through a straightforward maintenance work request or other simplified method.

Since the change has been determined to be equivalent, a design change as defined in this guideline has not occurred. This implies that the design change controls in ANSI N45.2.11 are not specifically applicable to equivalent changes. However, equivalent changes might result in changes to design output documents. Utilities are required to maintain controls for changes to design output documents commensurate with those applied to the original documents. These changes to controlled design documents are required to comply with Section 7 of ANSI N45.2.11, as defined by the site document control procedures.

Because a design change as defined in this guideline has not occurred, the design verification requirements in ANSI N45.2.11 are not specifically applicable to equivalent changes. Equivalent changes to SSCs under the 10CFR50 Appendix B program should receive an independent review to verify that the evaluation/determination correctly concludes that there is no impact on the design bases of the SSC or interfacing SSCs. This review should also verify the technical adequacy of the equivalent change. Although an independent design verification in accordance with Section 6 of ANSI N45.2.11 is not required for equivalent changes, utilities may choose to use their design verification process as a conservative approach to performing the independent review.

If the evaluation shows that the engineering change cannot be processed as an equivalent change, the process reverts to the design change process described in Section 4.7.

Section 4.6 Summary Recommendations

1. Use of an equivalent change should be considered when the justification for its use can be accomplished by an evaluation process that remains simple. This approach will accommodate the large majority of equivalent changes that are straightforward.
2. A 10CFR50.59 screen is required as part of evaluating an equivalent change. Performance and documentation of an equivalency evaluation meets the intent of a 10CFR50.59 screen because the equivalency evaluation confirms that there is no adverse impact to a design function and therefore provides the basis for screening the change out of 10CFR50.59. A licensee’s equivalency evaluation may be used as an alternate screening tool.

Section C.3 and C.4 are examples of equivalent changes that result in document-only changes. Section C.5 and C.6 are examples of equivalent changes that results in changes to both SSCs and associated documents.

4.7 Detailed Process for Design Changes to CPE

This section describes processing of design changes that affect CPE (see Figure 4-5). This category of changes includes obvious hardware changes or additions to CPE, but also might include instrument set point changes and equipment that is retired in place, which may not be as obvious. Design changes might result in document-only changes if they alter bounded technical requirements related to licensing basis commitments or design basis functions.

As Figure 4-5 illustrates, no attempt is made to discriminate between major and minor design changes. Instead, the screens are used to build each change package to the technical and administrative content commensurate with the nature of the change. By use of the screens, incremental increases in change package content are developed, based on specific requirements for that package.

Providing a change methodology with this continuum of required effort allows each utility to exercise, to the greatest extent, their best innovative thinking to optimize the process. This approach places a premium on engineering expertise and training (see Section 5).

4.7.1 Engineering Change Scoping Screen

This process begins with an established need for a given hardware design change. First, the change is subjected to the engineering change scoping screen (see Table 4-1) to assess the need for a conceptual design, interdisciplinary reviews, field walkdowns, and so on. These additional reviews and scoping tasks determined to be necessary are performed and documented in accordance with a given utility's individual procedures as appropriate. In addition, each utility should determine to what extent the review documentation should be a part of the overall change package.

4.7.2 Engineering Review Screen

Following completion of the appropriate scoping reviews and incorporation of appropriate engineering inputs, the change package is subjected to the engineering review screen (see Table 4-3). At this point, the need for specific detailed programmatic engineering reviews, a 10CFR50.59 screen/evaluation, and independent design verification is determined, and the reviews are performed as necessary.

Although not explicitly shown in Figure 4-5, it is anticipated that changes to the original conceptual design, problem solutions, and detailed design may be necessary to resolve problems identified by the various engineering reviews. In addition, each utility should determine to what extent the review documentation needs to be a part of the overall change package. As the change process commences, preliminary closeout support activities should be considered (see Section 4.9).

4.7.3 Package Development and Approval

Following completion of the engineering reviews and resolution of any review issues, the detailed change package is assembled. Appropriate design control approvals, reviews, and final approval are obtained in accordance with each utility's internal procedures. Many of the review and approval steps previously required at this point may not be necessary, and many of the ones that are necessary can be addressed prior to package assembly. The screening processes recommended by this guideline will help the engineer identify those reviews and approvals required for the design change. This screening can be accomplished by changing the procedures and/or the approval forms used for this part of the process. For instance, some utilities use a single person technical review to issue an approved package.

4.7.4 Processing Design Changes

4.7.4.1 Document-Only Design Changes

Document-only design changes do not involve field implementation. Implementation is generally accomplished through existing document or database revision-control procedures.

Document-only changes that adversely affect the plant safety analyses, design bases, or technical requirements that (1) ensure performance of design basis functions or (2) ensure compliance with the plant licensing bases must be processed as design changes. Consequently, these changes require screening under 10CFR50.59 and preparation of written 10CFR50.59 evaluations, as required. These changes must also be processed in accordance with ANSI N 45.2.11 because changes to this information alter the technical information in plant design basis, design input, or design output documents.

Document-only design changes that affect operations-critical documents might require an operations turnover process to ensure that superseded documents are properly removed from use and that any necessary operator training or qualification requirements are met. Sections C.7 and C.8 are examples of design changes that result in document-only changes.

4.7.4.2 Hardware Design Changes

When the approved change package is received, appropriate installation instructions, inspection requirements, and post-modification retest instructions should be prepared. Detailed information on this aspect of the change process is beyond the scope of this guideline. However, many actions taken by the responsible engineer before package turnover can significantly improve the likelihood of successful implementation. Based on individual program structure, several or all of the following points should be considered for inclusion in approved change packages or as aids in the process. This subsection also applies to the other types of changes described in this guideline.

- Develop flexible criteria for installation that allow for implementation of the change within an accepted range of parameters. This avoids unnecessary field revisions and lost time determining acceptability of an implementation to rigid criteria.
- Identify material requirements during package development and ensure that they are reserved or procured prior to implementation, thereby avoiding delays during implementation. In addition, an effort should be made to use standard materials and available inventory whenever possible.
- Consider developing the change package to allow work not requiring plant or system down time to be performed independent of work requiring down time.

- Use phased implementation and development of change packages to complement other plant schedules.
- Use lessons learned from previous changes in current and future planning.
- Evaluate whether surveillance, construction, and post-modification testing can be combined.
- Consider dry running permanent surveillance tests associated with the change as part of post-modification testing.
- Foster communication between the designer, installer, and others impacted by the change to ensure that elements of the change are thoroughly understood by all parties.
- The experience of the staff implementing a change should be known to the responsible engineer, and this experience level should be factored into the details provided in the change package.
- Avoid excessive use of boilerplate or redundant information in the package, unless it adds measurable value.
- Electronic approvals can aid in tracking change package approval status and are being used effectively by some organizations.

The processing of field change requests (FCRs), as it relates to design, is an important part of the process. If problems arise during field implementation, the process shown in Figure 4-5 allows for generation of FCRs to obtain quick engineering approval that allows field work to continue unimpeded. It is recommended that mechanisms be included in the process to allow for advanced approvals, with formal revisions to the change package occurring after field implementation but before return to operation. In this way, installation activities need not be interrupted while awaiting approval for relatively minor changes. The impact of the FCR and/or modifications to the change package on the 10CFR50.59 evaluation should be determined prior to turnover to operations/owner. The installation proceeds at risk, pending receipt of final engineering approval. One such process is shown in Figure 4-5, but it is not the only process that can be effective.

Sections C.9 and C.10 are examples of the design change process that results in changes to both SSCs and associated documents.

Section 4.7 Summary Recommendations

1. The engineering change process should be guided by a methodology that considers appropriate requirements associated with a given change in determining the effort involved with such a change. The simplest changes should have the least effort involved, and the effort should increase only incrementally according to the additional needs of the change.
2. Independent design verification is required only for design changes that fall under a utility's 10CFR50 Appendix B program.
3. Programs should be structured to limit engineering reviews to only the involved or affected disciplines.
4. The closeout process should include a graduated closeout that allows for rapid closeout of critical documents required for operation and has limited requirements for passive engineering drawings that are unlikely to impact operations.

4.8 Generic Changes

The generic change process is being treated separately here because this method of implementing engineering changes avoids much of the repetitive and cumbersome administrative burden involved in processing similar, limited changes individually. The concept of generic changes can be applied to equivalent changes and design changes, and it can apply to either hardware or document-only changes. This approach involves enveloping a group of changes into a shell document that specifies the items that can be addressed in the generic change, applicable criteria, interfaces, references, and documentation requirements. The generic document pre-establishes the maximum scope of the change by identifying which components or types of components can be changed and the extent of the changes. It is then amended to reflect the individual changes it covers. Alternatively, a very specific change can be identified and this change can be accomplished repeatedly, provided it stays within the specific criteria established in the shell document.

The benefits of this approach include reduced effort to develop similar changes, fewer interface and approval requirements, and therefore, more rapid, less costly implementation of changes. Although utility definition of, and implementation practice for, generic changes will vary, it is important that the concept of generic changes be considered and integrated into the engineering change process. Some typical examples that warrant use of a generic change process include the following:

- Developing a complete change package for multiple plant applications, such as the following changes:
  – The addition of video cameras at various locations throughout the plant
  – The change-out of installed transformers to those made by a different manufacturer

- Developing the major elements of a change package (such as screens/reviews, 10CFR50.59 evaluations, calculations, and preliminary drawings) which envelop a specific family of single or multiple plant applications, such as the following adjustments to pipe supports:
  - Addition of gusset plates
  - Replacement of anchor bolts or increase of anchorage capacity including base plate extensions and associated stiffener plates
  - Hanger replacement with a different assembly of support members which provide equivalent specified restraint capability (that is, a reconfigured rigid strut for an existing rigid strut)
  - Addition of shim plates to achieve required gap dimensions
  - Weld detail revisions
  - Relocation of support attachment point within approximately one pipe diameter of the point specified in the pipe stress analysis

Section C.11 is an example of a generic engineering change.

Section 4.8 Summary Recommendations

1. The use of generic changes with enveloping criteria, 10CFR50.59 screens/evaluations, and documentation should be considered as a means of reducing engineering effort and the amount of time required for a change to be implemented.
2. Generic engineering changes use the same process for evaluating changes as for any engineering change, with key differences noted during closeout and how plant configuration is controlled.

4.9 Closeout Support Activities

4.9.1 General Guidance

All engineering changes involve some activities necessary to close out the engineering processes, turn the equipment back over to operations, and update plant documents to ensure that plant configuration control is maintained. The degree of closeout activity can vary depending on the type of engineering change being implemented. For the purpose of this report, closeout activities are divided into three phases: preliminary closeout activities, owner acceptance, and final closeout. For each phase, the key aspects are when to start, what actions must be completed in each phase, and how milestones can be identified to measure progress throughout each phase.

4.9.2 Preliminary Closeout Support Activities

A plan for closing out an engineering change should be considered and addressed as the engineering change is being developed. The following preliminary activities should be performed:

- Identify affected documents to be updated at closeout.
  - It is recommended that development of a list of affected documents be a planned activity, commensurate with its importance to maintaining plant configuration. Table 4-4 provides an example of a graduated system of drawing update.
- Develop a closeout plan considering resources needed, responsibilities, and schedule.
- Begin preparation of change documents and closeout items. Items most often affected by engineering changes are as follows:
  - Design/vendor drawings
  - Design documents (calculations, specifications, analysis, databases, design basis documents, set points, program documents, vendor manuals)
  - Procedures/activity/document control (operations, maintenance, preventive maintenance)
  - Training/simulation modules
  - Materials/tools (stores, inventory, removed obsolete items, database updates)
  - Labeling requirements
  - Miscellaneous (final testing, open items, correspondence)
- Notify affected organizations responsible for training, procedures, program, and systems.

4.9.3 Owner Acceptance of Engineering Change and Turnover

Following completion of field implementation, appropriate engineering support is provided in returning the modified component or system to operation. Finally, required documentation changes are made and the change package is closed out.

The following activities should be considered when obtaining owner acceptance of an engineering change:

- Revise documents necessary for turnover/acceptance (drawings, engineering documents, program documents, training, procedures, walkdown records, licensing basis documents).
  - It is recommended that the closeout process for a change involving CPE include a graduated update with high-priority items accomplished before turnover to operations.
- Prepare a turnover release document (documented completed actions, documented acceptance by owner, identification of open items/exceptions).

- Develop a mechanism for partial release/turnover.
- Establish actions required to verify operability (walkdown records, testing, labeling, analysis or calculation update, testing acceptability review by owner).

4.9.4 Final Closeout Activities

Final closeout activities should primarily ensure the following:

- Finalize the closeout plan and assign resources to achieve timely closeout (list of closeout actions/documents, identification of responsibilities/resources, contents of closeout package, reviews and approvals, provisions for extended activities after closeout is complete—that is, ownership, follow-up, and so on—activity milestones, and tracking system).
- Perform closeout activities in accordance with the plan (use checklist, coordinate activities, document completed activities, prepare final closeout package for records retention, and obtain necessary reviews and approvals).

Section 6, Performance Measurements, describes methods to track and trend closeout performance. Section D.1 provides an additional example of a specific drawing revision priority system similar to the one displayed in Table 4-4.

Table 4-4
Example of a Graduated Closeout Update Process

Generic Graduated Closeout Process
The following summary was taken from NUREG 1397, *An Assessment of Design Control Practices and Design Reconstitution Programs in the Nuclear Power Industry*. It is representative of a prioritization methodology to schedule revisions to documents that require update.
Priority 1: This category contains drawings defined by the operations organization as critical to plant operations. These drawings are updated as part of the turnover process and available in the control room. This set of drawings consists of piping and instrumentation diagrams (P&IDs), one-line electrical diagrams, logic diagrams, valve index, and circuit breaker list diagrams.
Priority 2: This category contains control room drawings defined by the operations organization as second-tier operating documents. These drawings are updated and available in the control room within 30 days from the time a system has become operational. This set of drawings consists of elementary wiring diagrams and schematics, P&IDs not included in Priority 1, and instrument loop diagrams.
Priority 3: This category contains drawings and documents defined by the maintenance organization (not included in Priority 1 and 2) as critical to plant maintenance. These drawings are updated within 60 days from the time operations has accepted a system. However, these drawings are not available in the control room. This set of drawings consists of electrical connection diagrams, internal wiring diagrams, cable and raceway schedule, lighting and raceway drawings, selected vendor drawings that contain maintenance information, Q-list and EQ-list (equipment qualification list of components), total equipment database, and pipe hanger drawings.
Priority 4: This category contains drawings and documents defined by the engineering organization (not included in Priority 1 through 3) as critical to engineering. These drawings are updated within 90 days from the time operations accepts a system. This set of drawings consists of documents related to Appendix R criteria, piping isometrics, welding procedures, security hardware, equipment list, heat-balance diagram, yard piping, and specifications.
Priority 5: This category contains the remaining drawings and documents that are not identified in Priorities 1 through 4. These documents are updated on an as-requested basis within 180 days after the request is received. This set of drawings consists of historical information on erection drawings, drawings such as piping plan views, and those drawings unlikely to be affected by a design change, such as component outlines, printed circuit card schematics, foundations, and masonry.

5 TRAINING

In order for the engineering change process described in this guideline to obtain optimal results, it is recognized that additional training might be necessary. The process relies in part on engineers making correct judgments about categorizing a change, selecting the appropriate administrative and technical components of the change package, and selecting the additional reviews that add value to the process while eliminating those that do not.

This section describes five areas in which it is recommended that current training programs be supplemented to enhance the effectiveness of implementing a streamlined engineering change process. This section also provides guidance for developing and conducting training on the engineering change process.

5.1 Engineering Judgment

The recommended process requires that informed engineering decisions be made during the categorization and screening process. Senior-level engineers with considerable experience and training should be making the majority of these judgments. Similarly, the technical review or design verifications will be performed by experienced personnel. The need to train engineers in the thought process and decision criteria contained in this guideline should be considered in the training program.

5.2 Program Impact Considerations

Using screens and reviews to provide intelligent routing of engineering changes places an increased burden on the engineer’s knowledge of plant design and commitments. Training programs should be enhanced with particular emphasis placed on the knowledge level in areas involving plant program commitments, such as fire protection, radwaste, ALARA, configuration management, cobalt reduction, and so on. Engineers and supervisors performing, reviewing, and approving decision screens should have a thorough understanding of potential impacts on plant program commitments.

5.3 Business Considerations

Engineering personnel are generally experienced in technical issues and administrative control programs. However, use of the recommended engineering change process requires engineers to make more business-oriented decisions. For example, the process calls for engineers to determine, based on the decision criteria provided herein, whether or not a project plan, conceptual design, or alternate solutions report is necessary. These are decisions that require a business orientation. The business part of the process, therefore, should be a part of the enhanced training program.

5.4 Communication Outside the Nuclear Jurisdiction

An important feature of the recommended process is the ability to implement changes outside of the nuclear jurisdiction in accordance with commercial controls. Implementing changes to commercial controls requires an evaluation of potential tie-ins to CPE. Some decision criteria are provided in the Table 4-2 engineering review screen. It is envisioned that if this feature of the process is to be used optimally, some changes made through commercial controls may have portions evaluated under the nuclear program. For this reason, communication between the nuclear organization and the commercial organization needs to be effective. This aspect of communication between organizations should be emphasized in the training program.

5.5 Management Involvement

As with any process improvement effort—and particularly one that touches virtually every organization at a nuclear power plant—management must support the effort in a very public way. Management must play an important role in providing leadership and credibility to the streamlining process and in setting continuing improvement expectations. A key aspect of the training program should be prominent management participation.

5.6 Training Development and Implementation

5.6.1 Training Objectives

Prior to conducting training, a list of learning objectives should be established based on input from engineering managers and those engineers who are required to implement the engineering change process. Typically, the learning objectives for training regarding the engineering change process include and address the following:

- Recognize the need for exercising sound engineering judgment when processing an engineering change (see Section 5.1).
- Demonstrate knowledge of current plant-specific programs impacted when processing engineering changes (see Section 5.2).
- Understand business and cost/benefit considerations affecting the engineering change process to optimize value added by the engineering change (see Section 5.3.)
- Demonstrate knowledge of the change process implemented using commercial controls and how communications with organizations of the nuclear jurisdiction can be optimized (see Section 5.4).
- Demonstrate knowledge of current industry regulations and guidance.

- Demonstrate knowledge of current plant-specific procedures for implementing engineering changes.
- Demonstrate knowledge of plant design basis documents and the tools available for retrieving design basis information and for identifying the impact of engineering changes on controlled documents.
- Demonstrate understanding of how to apply the different types of engineering changes.
- Ensure that the proper level of review/approval/verification is used.
- Demonstrate how to close out various types of engineering changes.

5.6.2 Training Attendees

All personnel involved in the engineering change process should receive training. Some of the key organizations that could benefit from this type of training include the following:

- Design engineering
- Procurement engineering
- Systems engineering
- Utility or plant programs (for example, EQ, fire protection, security, and so on)
- Quality assurance
- Maintenance or outage planning
- Licensing

Training may be tailored for each organization to optimize its relevancy, to ensure that interfacing work processes are emphasized, and to match the skill levels of the employees attending the training.

5.6.3 Training Format

The format of the training should be selected to optimize the ability of each engineer to learn the subject matter and retain the knowledge for effective implementation of the process. Experience has shown that a small-group workshop is an effective format for conducting training on the engineering change process. Ideally, engineers should be provided with background information—such as industry regulations, INPO or EPRI guidelines, and plant procedures—prior to attending the workshop. The workshop should be led by a subject matter expert (SME), who in most cases should be an experienced engineer or engineering supervisor. The SME should review the background material and facilitate discussion among the engineering attendees.

After the lecture and discussion, the SME should allow the group to solve examples or case studies. These exercises might constitute actual utility examples or might replicate those examples provided in this report. In-class exercises should then be reviewed to enforce learning objectives and some measure of the effectiveness of the training should be used.

6 PERFORMANCE MEASURES

Measuring performance of a process with highly variable outputs is much more difficult than a process that consistently produces the same output. The engineering change process rarely produces two items that are the same, and therein lies the difficulty in developing effective ways to measure improvement.

Input from participating utilities indicated that most attempted to measure performance in certain areas, but none had a method to measure the improvement after implementing a streamlined process. This section recommends performance measurements that enable the utility to measure improvement to the engineering change process through a number of indicators.

The performance indicators presented are in the following areas:

- Cycle time improvement. The total time required to accomplish a particular activity.
- Productivity improvement. The hours required to perform engineering changes, or the relationship between total costs and engineering costs.
- Closeout improvements. Hours expended for each closeout, or backlog of closeout items in terms of number and age.
- Customer satisfaction. Number of field changes and maintenance work orders that are on hold.
- Quality assessment. Measure and trending of the amount of rework that is necessary due to engineering errors and process inefficiencies.

6.1 Process Improvement Measurements

This section describes a number of specific measures that can be implemented to demonstrate improvement in the engineering change process after implementing a streamlining initiative.

6.1.1 Cycle Time Improvement

Utilities should be able to implement engineering changes more efficiently after streamlining. One way to measure this is by monitoring *cycle time*, which is defined as the time from a decision to implement an engineering change through turnover to operations. Each stage of the process is measured and trended; that is, total days from initiation to release to field, total days from release to field to turnover to operations, total days for internal reviews, and so on. In addition, these indicators are applied to each type of engineering change as well as the composite of all engineering changes.

Although cycle time can be a good measure of improvement, the following several factors must be kept in mind:

- If cycle time is tracked too extensively, it can require significant time and effort. Therefore, a sampling approach may be more appropriate.
- Cycle time is affected by competing priorities. This must be taken into account in measuring a given population of changes. It may be necessary for the sample population to include a range of priorities to compensate for this competition or to include a group with a high priority to eliminate this factor.
- Cycle time may be more useful for document-only changes or equivalent changes, where the scope of the change is similar and priority is not as significant a factor.

6.1.2 Productivity Improvements

The engineering change process improvements recommended in this guideline should enable a utility to implement engineering changes more efficiently; that is, more engineering changes should be completed for the same number of engineering hours. One way to measure this productivity is by trending the total number of engineering changes implemented divided by the total number of hours necessary to implement the changes. Again, this indicator is developed for each type of change as well as the composite total number of changes.

Another method to help utilities measure productivity improvement is by trending the total expended dollars for engineering changes (minus material costs) divided by the total hours needed to implement the changes. Again, the indicator is developed for each type of change as well as the composite total number of changes.

If the engineering change process has improved, the total number of changes for each engineering hour should increase, and the total dollars expended for each engineering change should decrease.

The measurements will be indicators of two other benefits. First, the dollars spent for each type of change will indicate whether an organization's distribution of changes is moving to less intensive effort categories (for example, more changes are made under commercial controls and fewer under the ANSI N45.2.11 program). Since this is a primary objective of streamlining, such an indicator is quite important. Second, the dollars spent for a given type of change indicates which change processes are being implemented more cost effectively than the others.

6.2 Closeout Phase Performance Indicators

Prompt and complete closure of engineering change efforts is another indicator of a streamlined process. Two ways to measure effectiveness are trending of hours spent for each closeout and the backlog of outstanding items.

Trending the hours expended for each closeout provides an indication of improvement in this part of the process. The streamlined process, which incorporates a graduated update, should significantly reduce the hours for closeout. This is because there should be fewer documents for each package (fewer reviews) and less documentation that requires update.

Backlog, both number and age, of closeout items to be completed is a common indicator. The target values for this indicator may vary based on plant conditions. For example, during and after an outage, the acceptable number of backlogged items may be higher than during the period before the outage.

6.3 Customer Satisfaction

Another indicator of improved performance of the design change process is customer satisfaction, as viewed from a plant perspective. Depending on the organization, measuring the number of field changes and maintenance work orders that are on hold due to engineering problems can provide an indication of the impact of a streamlined change process. Another technique can involve direct customer feedback through surveys, interviews, and/or critiques.

6.4 Quality Assessment

Quality assessment should be considered as another means of measuring the performance and continued improvement of the engineering change process. One indicator of quality engineering that should be considered is the amount of rework necessary to produce error-free engineering outputs. Rework might be measured in terms of work hours or cost and might be categorized based on the causes of the rework. Assessing the quality of the engineering change process can be achieved through self-assessments or with audits from the site’s quality assurance organizations. Assessment results, including the causes for rework, should be trended over time. Trending should result in management action when the trends indicate degraded performance.

6.5 Summary

This section offers several ways to monitor improvements to the engineering change process. Selection of any of these by an individual utility will clearly be based on their objectives and priorities. However, whatever performance indicators are selected, it is recommended that they have a responsible owner to monitor, interpret, and sponsor them. In addition, a plan should be established for implementation of any actions indicated by these performance measures.

7
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A
EXAMPLES OF CATEGORIZATION OF CPE

This appendix presents two examples of utility programs for categorization and screening of CPE. It consists of the following subsections:

- Section A.1 presents an example of implementing commercial controls by referencing a programmatic list of commercially controlled SSCs.
- Section A.2 presents an example of a screen used prior to implementing commercial controls that might be used on a case-by-case basis.

A.1 Implementing Commercial Controls by Referencing a Programmatic List of Commercially Controlled SSCs

Different philosophies will influence how control of equipment and facilities outside the nuclear sphere of influence is managed by different utilities. This section provides an example in which equipment is categorized by site facility and system.

A.1.1 Categorization of SSCs

Category 1. The following list of structures/areas, along with associated systems and components, are considered CPE. All modifications to these structures/areas and to systems and components within them are to be processed by a change package. (This excludes divider walls that do not span from floor to ceiling, arrangement of furnishings in offices, and non-emergency-plan telephones.)

Table A-1
Category 1 SSCs

Structure/Area	Name	Notes
Z001	Auxiliary Bldg. and Hot Machine Shop	8
Z002	Reactor Bldg.	
Z003	Control Bldg. and Communication Corridor	8
Z004	Turbine Bldg.	8
Z005	Diesel Generator Bldg.	
Z006	Fuel Bldg.	
Z007	Radwaste Bldg.	8
Z011	Drum Storage Bldg.	
Z018	ESW Pump Bldg.	
Z019	Circulating Water Screen House	8
Z020	Heating Fuel Oil Storage Tank and Pump House	
Z022	Circulating Water Discharge Structure	
Z023	Site Diesel Generator Bldg. (Security D/G)	
Z026	Makeup Water Discharge Structure (MUDS)	
Z027	Meteorological Tower	
Z036	Lime Sludge Pond	
Z043	Accelerometer	
Z051	Main Dam Structure	
Z055	Emergency Fuel Oil Tank and Vent	
Z060	Lake Area	1
Z065	Ultimate Heat Sink	
Z093	ESWS Valve Pit and Access Vaults	

Category 2. In the following structures/areas, modifications to the indicated plant systems are to be processed with a change package. All other modifications are to be processed by methods that meet commercial controls (see Notes 4–6 and Section A.1.3).

Table A-2
Category 2 SSCs

Structure/Area	Name	Systems Requiring a Change Package	Notes
Z012	Shop Bldg.	AX, CL, CZ, DC, EW, HT, PP, SL, SZ, UU, and WM	
Z015	Technical Support Center (TSC)	RJ and RT	2
Z014	Support Bldg. West	FQ	
Z016	Admin. Bldg.	FQ	
Z017	Primary and Second. Security Bldg.	Everything except HVAC and KD	7
Z019A	Circulating Water Pump Enclosure	Everything except HVAC	7
Z024	Makeup Water Screen House Structure	CQ, DC, HT, QF, SZ, UU, WL, and WM	7
Z025A	Learning Center Bldg. A	CS, FQ, and QE	2
Z025B	Learning Center Bldg. B	FQ	2
Z025C	Learning Center Bldg. C	FQ	
Z028	Dosimetry Bldg.	FQ	
Z030	Construction Admin. Bldg.	FQ	
Z031	Main Warehouse	CQ and SL	7
Z034	Elec./Health Physics Bldg.	FQ	
Z037	Wastewater Treatment Facility	HF, PS, SL, and WM	
Z042	Chlorine House for Shop Bldg. Water Treatment	WM	
Z045	Paint Shop	FQ	
Z050	Site Yard - Inside PAB	CL, CQ, FQ, HT, and RZ	7
Z051A	Blowdown Discharge Structure	CQ, HT, SL, UU, and WL	7
Z052	Chlorine Storage Shed	CW, WS	
Z061	On-the-Job Training Bldg. (OJT)	FQ	
Z090	Site Yard - Outside PAB	AX, CL, CQ, FQ, HT, RZ, and SY	7
Z091	Executive Office Bldg.	FQ	
Z092	Material Management Bldg.	FQ	
Z095	Support Bldg. (East)	FQ	
Z101	General Office Building	FQ	

Table A-3
System Descriptions for Category 2 SSCs

Abbreviation	System	Abbreviation	System
AX	Acid Feed	PS	Site Power Loop
CL	Chlorination	QE	Telephone System
CQ	Site Security	RZ	Alert and Notification
CS	Communication	SL	Auxiliary Power
CW	Circulating Water	ST	Sewage Treatment
CZ	Caustic Handling	SY	Switchyard
DC	Battery and DC Distribution	SZ	Service Air
EW	Welding Receptacles	UU	Supervisory Control
FQ	Fiber Optics Comm.	WD	Domestic Potable Water (Production Portion Only)
HF	Secondary Liquid Waste	WL	Cooling Lake Makeup Water/Blowdown
HT	Heat Tracing	WM	Makeup Demineralizer
KD	Domestic Water	WS	Service Water
PP	Power Panel		

Category 3. Modifications to the following structures/areas are to be processed by methods that meet commercial controls (see Notes 4–6 and Section A.1.3).

Table A-4
Category 3 SSCs

Structure/Area	Name	Notes
Z011A	Rad Storage Enclosure	
Z013	ESW Chlorinator Bldg.	
Z021	Sewage Treatment Plant	
Z029	Lube Oil and Chemical Storage Bldg.	
Z033	Vehicle Maintenance Shop	
Z035	Fire Training Bldg./Area	
Z038	CO_2 and H_2 Storage Area	
Z039	Oxygen and Nitrogen Storage Area	
Z041	Engraving Shop	

Table A-4 (continued)
Category 3 SSCs

Structure/Area	Name	Notes
Z040	Cement Silo	
Z044	"Q" Paint Storage Bldg.	
Z046	Paint Storage Area	
Z047	Hazardous Waste Area	
Z048	Mixed Waste Storage Bldg.	
Z049	Waste Oil Storage Area	
Z053	Propane Gas Tank Area	
Z054	Anti-Scale Acid Tank and Pump House	
Z056	Northwest Laydown Yard	
Z057	Misc. Yard Foundation	
Z058	Potable Water Storage Tank and Pump House	
Z059	Garage (Old Ambulance Bldg.)	
Z062	Cable Reel Shop	
Z066A	Technical Learning Center	
Z066B	Vehicle Storage Building	
Z069	Site Services Shop	
Z070	Roadways	
Z080	Railroads	
Z094	Guardhouse at Main Gate North	
Z096	Acid Tank (currently not in use)	
Z097	North Residence	
Z100	Switchyard/Substation/Incoming transmission lines.	3
Z104	Sewage Treatment Lagoon	
	South Residence	
	Trailer #53	
	Anderson Farm	
	Environmental Education Area	

Notes to Tables A-1, A-2, and A-4:

1. Manmade changes to the lake's capacity, drainage, or foot print.
2. Coordinate all modifications to this building with emergency plan management.
3. Owner's scope of responsibility. On-site modifications will be coordinated with electrical design engineering.
4. All modifications to non-controlled SSCs shall be reviewed for impact on UFSAR, American Nuclear Insurers (ANI), E-plan, and the operating license.
5. All modifications to non-controlled SSCs outside of the owner controlled boundary (OCB) shall be reviewed for impact on environmental impact and impact on underground utility routing.
6. All modifications to non-controlled SSCs inside of the owner controlled boundary (OCB) shall be reviewed for impact on control room habitability, security plan, and mixed radwaste storage.
7. The fences requiring a change package are the PAB, the secondary barrier, and the vehicle barrier. In addition, any modification within a 40-foot isolation zone from one of these fences must address the fence as part of a screening analysis.
8. The following exterior hollow metal doors are classified as non-controlled SSCs, but shall be maintained as functional doors:

13221	43122	43223	CD1	CD9
33031	43132	71143	CD2	CD10
33043	43142	71323	CD3	CD11
43092	43151	72261	CD4	CD12
43102	43211	72264	CD7	

A.1.2 Processing an Engineering Change

After a proposed change has been evaluated for impact on CPE, the change is processed under the CPE or commercial controls program, as applicable. Different documents are used to readily permit processing under the selected control program.

A.1.3 Implementing Commercial Controls

- Administrative services shall plan, design, implement, and coordinate all modification activities for non-controlled SSCs, including warehouse material.
- Administrative services shall ensure that the proposed modification does not impact the SAR, ANI, E-plan, or operating license. Administrative services shall review the proposed modification for impact on control room habitability, the security plan, and mixed radwaste storage. Contact design engineering if an impact is suspected.
- Administrative services shall coordinate all proposed modifications to the fire protection system with the responsible program engineer. If it is determined that the scope of the modification involves the special-scope portion of the system, a change package in accordance with appropriate site procedures will be required. This coordination will also facilitate required reviews and approval by the ANI, as needed.
- Without design engineering acceptance, all modifications are to be accomplished in compliance with applicable codes and standards, such as Uniform Building Code, Uniform Mechanical Code, Uniform Plumbing Code, National Electrical Code, and OSHA standards.
- Structural or major changes (as determined by administrative services) shall require department head approval.

- Modified essential drawings shall be updated. Necessary procedure/program changes and/or training, as a result of a modification, shall be coordinated with affected organizations.
- As-built information above that specified in the plant as-built criteria shall be the responsibility of administrative services, as they deem necessary. Document services will continue to warehouse plant/site drawings.
- Modifications affecting electrical loads on primary feeds (for example, area transformers) shall be coordinated with electrical design engineering.
- All proposed changes to plant communications/intercom equipment shall be coordinated with electrical design engineering
- A review of existing related controlled SSC drawings shall be performed by administrative services. If the accuracy of these drawings is affected by the non-controlled SSC modification, administrative services shall contact engineering to resolve the interface.
- Coordinate any modifications to non-controlled systems with system engineering.

A.2 Example of a Checklist for Determining Applicability of Commercial Controls

Any Yes answer to the following questions would prohibit the use of commercial controls for the proposed activity, unless authorized by an engineering manager.		**Yes**	**No**
1	Will changes have adverse interfaces with or the potential to adversely impact any system with nuclear control, including electrical power distribution systems, HVAC, pneumatic systems, instrumentation systems, or cooling water systems?		
2	Will changes have interfaces with existing fire suppression/detection systems, and prior approval has not been obtained from the Engineering Programs Department Fire Protection/Appendix R Section?		
3	Will the change introduce new or unanalyzed combustibles that may impact previous fire hazard analysis, and prior approval has not been obtained from the Engineering Programs Department Fire Protection/Appendix R Section?		
4	Will the change have adverse interfaces with equipment or systems listed in the post-fire safe shutdown analysis or safe shutdown equipment list?		
5	Will the change introduce new or unanalyzed toxic gases or other hazardous substances that would require a hazardous chemical evaluation or impact the control room habitability review?		
6	Will the change have the potential to impact previous site drainage or external flooding analysis?		
7	Will the change affect conclusions reached in the UFSAR about the design function or the method of performing the function of an SSC described in the UFSAR?		
8	Will the change have the potential to adversely impact the emergency plan?		
9	Will the change have the potential to create seismic interactions with CPE?		

Identify any interfaces with CPE:

____

____

Engineering Supervisor:________________________________Date:__________

Identify Applicable Design Requirements

Design Requirements	Yes	No	Reference Specific Issue or Section
MIOSHA			
Building Officials and Code Administrators International (BOCA)			
National Fire Protection Association (National Electric Code)			
NML & FM Insurance Requirements			
Dept. of Natural Resources			
EPA/NPDES Permit			
Other			

Include step in work order to notify initiator of the checklist prior to declaring WO operable so that drawings and/or procedures can be updated and operations training can be completed before equipment is operable.

Changes affecting plant electrical loads must be coordinated with Electrical Design Engineering Section.

Changes contributing to the plant fire loads or abandonment of combustible materials must be coordinated with Fire Protection/Appendix R Engineering Section.

After work has started, drawings shall be posted in accordance with plant procedures.

Identify Design Documents to Be Updated:

- Drawings
- Databases
- Vendor manuals
- Calculations
- Equipment specification
- Calibration sheets
- Procedures (including operations)

Procurement Considerations

Procurement of equipment is to be processed in accordance with plant procedures.

Testing/Operability Considerations

Adequate post-work testing is necessary to ensure that the activities conducted under commercial controls will satisfy the design requirements. Prior to declaring equipment operable, ensure that necessary operator training is complete, operations procedures are updated, and drawings required to support operability are processed in accordance with plant procedures.

Closeout

Walkdowns have been performed to verify that installation meets design. Spare parts have been ordered, and obsolete parts have been removed from stock. Changes have been submitted for all the design documents listed on this form, and training has been completed.

Initiator signature: ____Date: ______________

B
EXAMPLES OF ENGINEERING REVIEW SCREENS

This appendix provides examples of how utilities implement the engineering review screens described in this report. It consists of the following subsections:

- Section B.1 presents an example of how a utility performs an engineering review screen using a two-phased approach.
- Section B.2 presents an example of implementing the engineering review screen and the types of questions used to perform the screens.

B.1 Example of a Utility Engineering Review Screen (Detailed Impact Assessment)

The process is used to document a detailed impact assessment (DIA) of which engineering disciplines and organizations might require input to the engineering change process. The process is similar to and implements the guidance contained in Section 4.3.2, Engineering Review Screen. This screen consists of two parts.

Part 1 provides the method for the engineer preparing the design to determine all site impacts. The key points assessed during this part are the following:

- Determination of potential internal engineering cross-discipline impacts, using Part A questions from the General Design Review Standards (GDRS). The engineers’ responses are documented as shown in Table B-1.
- If any Part A questions identify impacts, the design change is forwarded to the affected discipline.
- Determination of whether there are any external impacts (organizations other than engineering disciplines) using guidance contained in the plant design control procedure.

Table B-1
Detailed Impact Assessment: Part 1, Impact Determination

Discipline	Analysis Required? Yes	No (Note 1)	Signature (if no analysis is required)
GD (RS) 01.00 – Fire Protection			
GD (RS) 02.00 – Human Factors			
GD (RS) 03.00 – ALARA			
GD (RS) 04.00 – ISI			
GD (RS) 05.00 – Equipment Qualification and 10CFR50.44			
GD (RS) 06.00 – Procurement			
GD (RS) 07.00 – Chemistry			
GD (RS) 08.00 – Electrical			
GD (RS) 09.00 – Mechanical			
GD (RS) 10.00 – Control/Instrumentation			
GD (RS) 11.00 – Civil/Structural			
GD (RS) 12.00 – HVAC			
GD (RS) 13.00 – System Engineer			
GD (RS) 14.00 – Computer Engineer			
GD (RS) 15.00 – Nuclear Engineer			
GD (RS) 16.00 – Simulator			
GD (RS) 17.00 – Industrial Safety			
GD (RS) 18.00 – PRA			
GD (RS) 19.00 – Maintenance Rule			
Plant Fire Protection			
Plant Operation			
Plant Radiation Protection (Note 2)			
Plant Maintenance			
Plant Security			
Training/Lesson Plans			
CPS Procedures			
LLRT/ILRT Required			

Table B-1 (continued)
Detailed Impact Assessment: Part 1, Impact Determination

Discipline	Analysis Required? Yes	No (Note 1)	Signature (if no analysis is required)
Flood Protection			
Operator Aids			
Installation and Testing Requirements (Note 2)			
Other:			

Notes:
1. All items marked Yes (having impact) shall be described in the Impact Description portion of this form (Part 2).

2. Includes RP, chemistry, and radiological programs.

Part 2 of the assessment allows affected engineering disciplines and groups external to engineering to document any impacts. Part 2 of the assessment is shown in Table B-2. Part 2 is also used to define when during the design process the impact must be resolved (that is, design completion, installation, turnover to operations, closeout, and so on). Engineering disciplines identify impacts by reviewing Part B questions provided in the General Design Review Standards (GDRS) for their respective disciplines. Tables B-3 through B-6 are provided as typical examples of the types of questions reviewed by the fire protection, ISI, procurement, and mechanical programs/disciplines, respectively.

Table B-2
Detailed Impact Assessment: Part 2, Impact Description

Impact or Action Required	Restraint to: D/C	(See Note) W/A	RFO	VLT	Comment Resolution (Include what received impact, signature, and date)

Assessment Originator: ______________________________

Note:

D/C = Design Complete W/A = Work Authorization
RFO = Release for Operations VLT = Vaulting

If the answer to all questions in Table B-3 is No, a fire protection/safe shutdown engineering analysis is not required. If the answer to one or more of the questions in Table B-3 is Yes, perform the fire protection/safe shutdown engineering analysis.

Table B-3
Example of a Detailed Impact Assessment (Fire Protection)

Item	Detailed Impact Assessment for Fire Protection
1	Will the change involve alteration or addition of barriers or fire-rated components (such as walls, floors, ceilings, doors, dampers, penetration seals, or fire-rated cable) or fire-protective coatings (such as fireproofing on steel or firewrap on conduits/cable trays)?
2	Will the change increase or decrease flammable or combustible quantities (such as flammable liquids or gases, cable insulation, plastic, charcoal, or HVAC ductwork) in the power block or screenhouse? See Standard ME-06.00 for definition of combustible materials.
3	Will the change introduce new or relocate existing equipment, cables, pipes, ducts, or instrumentation, for any plant system?
4	Will the change impact any portion of the plant systems (ADS, AP, CC, CM, DC, DG, DO, FW, HP, IA, IP, IS, LD, LL, LP, MS, NB, RD, RG, RH, RI, RP, RS, RT, SC, SX, VC, VD, VH, VX, VY) credited for post-fire safe shutdown?
5	Will the change involve alteration of the FP or CO systems or installation of manual or automatic fire suppression system(s)?
6	Will the change involve alteration or installation of fire detection system(s)?

If the answer to all questions in Table B-4 is No, an in-service inspection (ISI) engineering analysis is not required. If the answer to one or more of the questions in Table B-4 is Yes, perform the in-service inspection engineering analysis.

Table B-4
Example of a Detailed Impact Assessment (ISI)

Item	Detailed Impact Assessment for In-Service Inspection (ISI)
1	Does the change involve pumps and valves, instrumentation, or testing criteria required by Appendix V of the ISI Program Manual?
2	Does the change involve ASME piping, components, or support identified in the appendices of the ISI Program Manual?
3	Does the change alter the design parameters (for example, pressure or temperature) associated with ASME piping, components, or supports?
4	Does the change involve snubbers identified in Appendix VI of the ISI Program Manual?
5	Does the change add or delete any ASME piping, tubing, pumps, valves, supports, or snubbers?
6	Does the change alter the design parameters (for example, pressure or temperature) or add or delete ANSI B31.1 piping that could affect the flow accelerated corrosion program?
7	Is the change made as a result of wear in a piping system?
8	Does the change add any relief valves?

If the answer to all questions in Table B-5 is No, a procurement engineering analysis is not required. If the answer to one or more of the questions in Table B-5 is Yes, perform the procurement engineering analysis.

Table B-5
Example of a Detailed Impact Assessment (Procurement)

Item	Detailed Impact Assessment for Procurement
1	Does the design change require the procurement of material, equipment, or services?
2	Does this design change result in a deviation that affects current stock or spare material/parts (form, fit, function, material)?
3	Will the change require equipment or materials to be shipped off site?

If the answer to all questions in Table B-6 is No, a mechanical engineering analysis is not required. If the answer to one or more of the questions in Table B-6 is Yes, perform the mechanical engineering analysis.

Table B-6
Example of a Detailed Impact Assessment (Mechanical)

Item	Detailed Impact Assessment for Mechanical Engineering
1	Will the design change install abandon, retire, or remove a mechanical component (such as a pump, valve, pipe, heat exchanger, compressor, or pipe support)?
2	Will the design change alter service or application of or interface with a mechanical component (for example, temperature, pressure, level, humidity, rate, flow, or voltage)?

B.2 Implementing the Engineering Review Screen: Utility Example

Table B-7 is an example of one utility's implementation of the engineering review screen.

Table B-7
Example of an Engineering Review Screen

1 Hazards Analysis			
1.1	**Pipe Break Analysis. Does the change…**	**Yes**	**No**
A	alter the existing design functions or failure modes of equipment or structures intended to mitigate the consequences of a pipe break (for example, whip restraint, impingement barrier, floor drains, sumps, level sensors, water-tight doors, penetrations, or waterproof seals)?		
B	add or relocate any equipment or structures that if impacted by a high energy fluid jet, could affect the failure modes of any plant feature required to mitigate the consequences of a pipe failure?		
C	add or relocate safety-related components within an area susceptible to high energy jet impingement or pipe whip?		

Table B-7 (continued)
Example of an Engineering Review Screen

1 Hazards Analysis (continued)			
1.1	**Pipe Break Analysis. Does the change…**	**Yes**	**No**
D	add or modify piping or indoor storage tanks such that it alters the effects of spraying or wetting of safety-related components or raise the maximum flood level from the worst-case pipe crack or tank failure in a safety-related room or area (see also EQ issue 1.2)?		
E	add or relocate a high energy pipe in a safety-related building?		
If an answer is Yes, perform additional evaluation and attach to this screening.			
1.2	**Environmental Qualification. Does the change…**	**Yes**	**No**
A	modify a room or areas normal or accident environmental conditions as identified in the UFSAR? This includes temperature/pressure profiles, humidity, radiation and pH (containment spray).		
B	relocate, delete, or modify equipment covered by the Equipment Environmental Qualification Program? (UFSAR, Equipment Qualification Summary Document, Section II (ESQD-II) and the associated EQWP/MEQ.)		
C	add new safety-related equipment or any new equipment powered by a Class 1E power source? New safety-related equipment, whether in a harsh environment or mild environment, needs to be evaluated for inclusion in the EQ program.		
D	modify previously established maintenance/surveillance requirements for environmentally qualified equipment? EQSD-II, EQSD-III, EQWPs, and MEQs have information on EQ maintenance contingencies/requirements.		
E	involve a vendor part number change for equipment covered by the Equipment Environmental Qualification Program? (EQSD-III, EQWPs, and MEQs include vendor part numbers)		
F	alter any Class 1E equipment voltage or frequency limits?		
If an answer is Yes, perform additional evaluation and process in accordance with site procedures, if required. See NUREG 0588.			
1.3	**External Flood Hazard Evaluation. Does the change…**	**Yes**	**No**
A	alter existing design functions or failure modes of equipment providing external flood protection for safety-related buildings or equipment (for example, floor drains, sumps, level sensors, water-tight doors, penetrations, or waterproof seals)?		
B	relocate or add a safety-related component below the maximum flood level?		
C	alter the maximum flood level of a safety-related room (see also EQ issue 1.2)?		
D	affect external flood elevation, grade, or any feature relied on to protect the plant from external flood hazards?		
If an answer is Yes, perform additional evaluation and attach to this screening.			

Table B-7 (continued)
Example of an Engineering Review Screen

1 Hazards Analysis (continued)			
1.4	**Seismic Qualification. Does the change…**	**Yes**	**No**
A	alter seismic spectra, mass, orientation, mounting, center of gravity, material, location, geometry of safety-related equipment?		
B	modify a seismically designed component or structure?		
C	install new seismic Category I components, equipment and/or structures that have not been previously qualified to site seismic requirements?		
If an answer is Yes, perform additional evaluation and/or contact Civil Design Engineering as required.			
1.5	**Heavy Loads Evaluation. Does the change…**	**Yes**	**No**
A	alter a safe load path or establish a new safe load path?		
B	modify functions or failure modes relied on to protect against the effects of a heavy load drop?		
C	involve handling a heavy load (2000 lb or more) not previously analyzed?		
D	add or relocate a safe shutdown component in the vicinity of an established safe load path?		
E	add or modify the functions or failure modes of any system, component, or structure whose function is to lift or handle a heavy load?		
F	modify a structural member in the vicinity of an established safe load path or directly below a safe load path?		
If an answer is Yes, perform additional evaluation and attach to this screening.			
1.6	**Internal Missile Analysis. Does the change…**	**Yes**	**No**
A	modify existing or add new sources of internal missiles (for example, rotating/pressurized components) in a SR area?		
B	modify design functions or failure modes of existing missile protection features in safety-related areas (for example, walls, floors, or doors)?		
C	add or relocate safety-related equipment to areas that contain a missile hazard?		
If an answer is Yes, perform additional evaluation and attach to this screening.			

Table B-7 (continued)
Example of an Engineering Review Screen

1 Hazards Analysis (continued)			
1.7	**Tornado Analysis. Does the change…**	**Yes**	**No**
A	modify design functions or failure modes of walls, roofs, floors, doors, labyrinths, barriers, tornado dampers, and so on, that mitigate the effects of tornado missiles or differential pressures?		
B	modify design functions or failure modes of equipment relied on to annunciate/communicate tornado warnings?		
If an answer is Yes, perform additional evaluation and attach to this screening.			
1.8	**Control Room Habitability. Does the change…**	**Yes**	**No**
A	alter inputs to the original analyses as presented in the UFSAR?		
B	introduce an unanalyzed hazard?		
C	modify the functions or failure modes of any control room habitability system designed to mitigate the effects of hazards (for example, radiation shielding, radiation monitoring, carbon monoxide and carbon dioxide monitoring, chlorine and smoke detection capability, control room filtration, pressurization, air conditioning, and lighting)?		
D	change the type or location or increase the amount of any hazardous or noxious chemicals on site?		
If an answer is Yes, perform additional evaluation and attach to this screening.			
1.9	**Fire Protection. Does the change affect…**	**Yes**	**No**
A	passive fire protection design functions or failure modes of boundary walls, floors, ceilings, penetration seals, and so on?		
B	active fire protection design functions or failure modes of pumps, water supplies, sprinkler or halon systems, fire detection instrumentation, and so on?		
C	the fire hazards analysis (that is, increase/decrease combustible or flammable materials, add permanent ignition sources)?		
D	flame retardancy or fire coatings?		
E	related fire protection design functions or failure modes of communications, emergency lighting, capacity of floor drains, or other items contained in the Fire Protection Program Basis?		
F	an item in the ANI Fire/All Risk Guidelines?		
G	the safe shutdown design functions or failure modes of fire protection safe shutdown systems or components?		
If an answer is Yes, evaluate in accordance with site procedures.			

Table B-7 (continued)
Example of an Engineering Review Screen

1 Hazards Analysis (continued)			
1.10	**Electrical Distribution System Impact. Does the change…**	**Yes**	**No**
A	include any design that does not satisfy established circuit separation criteria (IEEE 384 and/or 10CFR50 Appendix R)?		
B	add or remove cable (routing, loading, and/or ampacity derating calculations)?		
C	increase the actual cable full load amps (FLA)? (ampacity derating calculations)		
D	increase or decrease the electrical load on any electrical distribution bus by 10KW or more? (load growth calculations)		
E	affect the safe shutdown following a fire function of a new or existing cable (10CFR50 Appendix R)?		
If an answer is Yes, Design Engineering Electrical shall evaluate the change. For cable trays, FLA ampacity, or load growth, see site procedures.			
1.11	**Seismic II/I. Does the change…**	**Yes**	**No**
A	add or relocate non-safety-related equipment which is not II/I supported in a safety-related area?		
B	create the need for a modified or new II/I analysis?		
C	add or relocate safety-related equipment that could be impacted by non II/I components during a seismic event?		
If an answer is Yes, evaluate in accordance with site procedures.			
1.12	**Interface Piping. Does the change…**	**Yes**	**No**
A	impact stress analysis inputs (that is, routing, materials, weights, loads) for interface piping (between a seismic Category I boundary out to the first point in the system identified as an anchor to a plant structure)?		
If an answer is Yes, perform additional evaluation and attach to this screening.			
1.13	**ALARA. Does the change…**	**Yes**	**No**
A	adversely impact the ALARA functions or failure modes of an existing component, structure, or system associated with radiological exposure?		
B	for new or replacement design/procurement work, does the change maintain or increase the use of cobalt (Stellite) in any system that could result in cobalt contamination entering the RCS?		
If the answer to A is Yes, evaluate in accordance with site procedures. If the answer to B is Yes, perform additional evaluation in accordance with site procedures.			

Table B-7 (continued)
Example of an Engineering Review Screen

1 Hazards Analysis (continued)			
1.14	**Probabilistic Safety Assessment (PSA) Review. Does the change…**	**Yes**	**No**
A	add or delete a pump, a remotely operated valve, a safety/relief valve, a tank, or a heat exchanger/cooler associated with a PSA significant system?		
B	replace an active component in a PSA significant system that is not an equivalent replacement (different failure mode)?		
C	change the safety-related function or failure mode of a component or system?		
If an answer is Yes, coordinate the change package with the PSA group.			
2 Human Factors Evaluation			
2.1	**Does the proposed change involve a change to commitments described in the UFSAR and specifically the correspondence identified with regard to site commitments for…**	**Yes**	**No**
A	main control boards or auxiliary shutdown panels affecting controls, displays, label/location aids, annunciators, devices, mimics, abbreviations, demarcation, nameplates, or scales?		
B	control room annunciation window locations or engravings?		
C	control room or auxiliary shutdown panel lighting, acoustics, communication facilities, humidity, or arrangements?		
If an answer is Yes, coordinate further evaluation with Licensing.			

Reviews and Signatures			
If required, additional evaluation must be attached or a change must be implemented to correct the concern. If additional evaluations are attached, list the applicable section number in comments:			
Comments:			
For CCPs, the reviewer’s signature also indicates that the technical review is completed.			
Prepared by		Date	
Reviewed by		Date	
Approved by		Date	

C
EXAMPLES OF ENGINEERING CHANGES

This appendix provides a number of examples showing the application of the engineering change process presented in this guideline. It consists of the following subsections:

- Section C.1 is an example of an engineering change made under a commercial controls program with interfaces to CPE.
- Section C.2 is an example of an administrative document-only change.
- Sections C.3 and C.4 are examples of equivalent changes that result in document-only changes.
- Sections C.5 and C.6 are examples of the equivalent change process that results in changes to both SSCs and associated documents.
- Sections C.7 and C.8 are examples of design changes that result in document-only changes.
- Sections C.9 and C.10 are examples of the design change process that results in changes to both SSCs and associated documents.
- Section C.11 is an example of a generic engineering change.

C.1 Engineering Change Under Commercial Controls (Addition of Gym to Onsite Facility)

For this example, refer to the flowcharts provided in Figures 4-1 and 4-2.

C.1.1 Need for the Engineering Change Established

The utility, as part of an employee benefit program, decided to add a gymnasium to the existing administration building. The building was located on site, outside the plant security fence, and currently housed engineering personnel who supported the plant and a number of computers that supported plant databases. The facility was to be constructed on a turnkey basis by a local contractor under commercial controls. Tie-ins from the plant included certain support systems including electrical power, fire protection, and cooling water.

C.1.2 CPE?

The administration building was determined to be on the list of structures outside of CPE. The process flow, therefore, follows Figure 4-2 from this point.

C.1.3 Screen for Potential Impact on CPE

The engineering change was evaluated against the criteria in Table 4-2, and potential impacts were identified in the following areas:

- Electrical, fire protection, and cooling water
- Site drainage
- Emergency plan

C.1.4 Evaluate Impacts

Nuclear engineering evaluated the change relative to the potential impacts and determined that the change could proceed without adverse impacts. The analyses were documented and forwarded to configuration management.

C.1.5 10CFR50.59 and 10CFR50.71 Screens

The 10CFR50.59 screen determined that the change to add the gymnasium did not alter the design function or method of performing the design function of any SSC described in the UFSAR.

The 10CFR50.71 screen identified general site arrangement drawings in the UFSAR that needed updating to show the location of the gymnasium.

C.1.6 Implement Commercial Controls

The work was contracted out to a local constructor. The detailed design was reviewed by nuclear engineering at the interface points specified. Electrical and cooling water loads were updated, and the final package forwarded to configuration management.

C.1.7 Turnover to Operations

Changes to electrical distribution, cooling water, and fire protection systems were turned over to operations to ensure appropriate procedures updates.

C.1.8 Closeout

Closeout activities are minimal as required by this particular utility's commercial controls program.

C.2 Administrative Document-Only Change (Valve Pressure Rating)

For this example, refer to the flowcharts provided in Figures 4-1 and 4-3.

C.2.1 Need for the Engineering Change Established

An evaluation of a technical issue revealed that a discrepancy existed in the documentation of the pressure ratings for some valves installed in the service water system. Plant design specification and vendor manuals indicated that the valves were rated at 150 lb, but the UFSAR and one design drawing contained two references to these valves that indicated they were rated at 1500 lb.

C.2.2 CPE?

Because the valves were considered to have an active functional mode, were classified as safety-related, and were located in the safety-related service water system, the valves were considered to be within CPE.

C.2.3 Administrative Document-Only Change?

The engineering change was processed as an administrative document-only change because the scope was limited to the inconsequential reconciliation of design documents, and did not involve any changes to plant hardware. The process flow, therefore, follows Figure 4-3 from this point.

C.2.4 Implement Administrative Document-Only Change

An engineering change package was prepared to evaluate the valve pressure ratings and to resolve the discrepancy. A 10CFR50.71 screen was performed, which revealed that a change to the UFSAR would be necessary. The discrepancy was determined to be a typographical error on the drawing that was incorporated in the UFSAR. The revision was included in the scope for an upcoming UFSAR revision. The discrepant drawing was also revised.

C.2.5 Closeout

Updated drawings were transmitted to affected disciplines.

C.3 Equivalent Change Resulting in a Document-Only Change (Valve Stem Part Number Change)

For this example, refer to the flowcharts provided in Figures 4-1 and 4-4.

C.3.1 Need for the Engineering Change Established

Information was received from a vendor indicating that the part number for a valve stem of a motor-operated control valve had been changed. The valve stem part number was currently contained in the station bill of material database as well as on an approved vendor bill of material drawing.

Engineering determined that the vendor changed the part number because a newer material standard was specified by the manufacturer of the stem, which superseded an obsolete standard. The only change in the new material standard was a requirement to document the completion of a nondestructive examination.

C.3.2 CPE?

Since the host valve was an active valve located in the safety-related high-pressure core injection system, the valve stem was considered to be within CPE.

C.3.3 Administrative Document-Only Change?

The change to the part number was not considered inconsequential (that is, a typographical error or the like) and was not processed as an administrative document-only change.

C.3.4 Equivalent Change?

Engineering questioned the vendor engineering department and validated that the new material standard did not affect any physical or chemical attributes of the material. Thus, no technical requirements bounded by the design bases for the valve had been modified, and the change was processed as an equivalent change. The process flow, therefore, follows Figure 4-4 from this point.

C.3.5 Engineering Review Screen for Changes Within CPE (Table 4-3)

An engineering review screen (see Table 4-3) revealed that the part number change might impact the 10CFR50 Appendix B program.

C.3.6 Prepare Equivalent Change Package

An equivalency evaluation was prepared by procurement engineering. The reason for the part number change was noted.

C.3.7 10CFR50.59 Screen

The 10CFR50.59 screen was performed, and it was determined that the change did not adversely affect the design function or the method of performing the design function of the valve as described in the UFSAR.

C.3.8 10CFR50.71 Screen

A 10CFR50.71 screen was completed but revealed that no references to the valve stem could be found in the UFSAR.

C.3.9 Hardware Change?

Since there were no changes to hardware, a document-only change was processed.

C.3.10 Implement Document-Only Change

The utility had established that piece-part technical descriptions, including part numbers, would maintain configuration control in the inventory management system database (1) to minimize paper changes, (2) to feed the station bill of materials program, and (3) to provide ready traceability to superseded part numbers.

C.3.11 Turnover to Operations

Turnover to operations was not required for this engineering change because the change did not require a physical modification or a change in operating status of any SSCs.

C.3.12 Closeout

A change to the materials information database was prepared and documented. The specification and purchase requisition for the stem were revised to specify the new part number.

C.4 Equivalent Change Resulting in Document-Only Change (Change Design Documents to Reflect As-Found Temperature Indicator Lead Termination)

For this example, refer to the flowcharts provided in Figures 4-1 and 4-4.

C.4.1 Need for the Engineering Change Established

While performing a test activity, a maintenance employee identified a discrepancy between the actual plant configuration and the configuration as shown on current controlled plant drawings. Leads from a temperature indicator were shown on existing drawings to be terminated on terminals 1 and 2 of their associated terminal block. The actual termination of these leads was found to be on terminals 3 and 4 of that block.

C.4.2 CPE?

The thermocouple is part of the emergency diesel generator control circuit, which is classified as safety-related. Therefore, this change affects CPE.

C.4.3 Administrative Document-Only Change?

This change affects the technical content of controlled plant drawings and is therefore not an administrative document-only change.

C.4.4 Equivalent Change?

An engineering evaluation was performed, and it was determined that the installed thermocouple, which provides a signal to the temperature indicator through the terminal block, included two sets of output signal leads. One set of these leads was connected to terminals 1 and 2 of the terminal block, and the second set was connected to terminals 3 and 4. Each set of leads provides the same output signal, with the second set serving as an installed spare for the first set. Further investigation indicated that the connection to the temperature indicator was transferred from terminals 1 and 2 to terminals 3 and 4 by a maintenance work order completed several years previously. This change had not been properly reflected on controlled plant drawings.

The review determined that the signal provided on terminals 3 and 4 is identical to that provided on terminals 1 and 2 in the original plant configuration and is an alternate equivalent configuration. The functional performance of the thermocouple and the temperature indicator is not affected in any way. The process flow, therefore, follows Figure 4-4 from this point.

C.4.5 Engineering Review Screen for Changes Within CPE (Table 4-3)

An engineering review screen (see Table 4-3) was performed to determine whether the proposed change affected any other nuclear-related programs. The only potential impacts of this minor change were in the areas of environmental qualification and fire protection analysis. The instrumentation affected is located in a mild environment zone, and is not subject to specific environmental qualification requirements. In addition, both sets of thermocouple leads are routed in the same conduit to the terminal block, so the change has no impact on the fire protection safe shutdown analysis. No detailed reviews for impacts on other programs were required.

C.4.6 Prepare Equivalent Change Package

No physical change to the plant was required. As such, the change package consisted only of the reviewed and approved drawing change notices (DCNs) to make the necessary updates to controlled plant drawings, and the engineering equivalency evaluation documenting the acceptability of the alternate configuration.

C.4.7 10CFR50.59 Screen

The 10CFR50.59 screen was performed, and it was determined that the change did not adversely affect the design function or the method of performing the design function of the temperature indicator.

C.4.8 10CFR50.71 Screen

A 10CFR50.71 screen was performed to determine whether the change affected descriptions included in the UFSAR. The affected thermocouple and temperature indicator wiring is not described in the UFSAR, and no revision is necessary as a result of this change.

C.4.9 Hardware Change?

This change was processed to ensure that design documents matched the installed configuration of plant equipment. No changes to plant equipment were required.

C.4.10 Implement Document-Only Change

The necessary DCNs were submitted to document control for the affected electrical drawings.

C.4.11 Turnover to Operations

No operations turnover was required for this minor change.

C.4.12 Closeout

No high-priority drawings were affected, and the DCNs were incorporated at the next revision of the affected drawings.

C.5 Equivalent Change Resulting in a Hardware Change to SSCs (Pressure Switch Replacements)

For this example, refer to the flowcharts provided in Figures 4-1 and 4-4.

C.5.1 Need for the Engineering Change Established

The utility was made aware of an internal fluid leakage problem with AOB pressure switches with an O-ring seal configuration through NRC notices and bulletins. During the procurement of an environmentally and seismically qualified replacement pressure switch, model ABC-XX6, AOB informed the utility that the switch was being replaced by a new design. The new model, ABC-XX12, would still be qualified to the same test reports, but it had a new primary diaphragm material, internal configuration, and manufacturing method.

C.5.2 CPE?

The pressure switches were used in the safety injection system to monitor system pressure, were classified as safety-related, and were considered to be within CPE.

C.5.3 Administrative Document-Only Change?

The new pressure switch model is different from the original configuration and will require a change that affects installed configuration. Therefore, the change is not an administrative document-only change.

C.5.4 Equivalent Change?

The new pressure switch was evaluated to the current design bases. To simplify presentation of the analysis, the following tables have been prepared as a summary. Table C-1 provides a summary of the design bases requirements that were evaluated, and Table C-2 lists the required document or database changes necessary to use the new switch.

Table C-1
Summary of Design Basis Requirements

Design Basis Attribute	Required Value	Original Equipment	Replacement Equipment	Evaluation Results
Set-Point Range	25–35 psi	10–100 psi	10–100 psi	Meets requirements
Pressure Rating/ Proof Pressure	1800 psi/NA	3000/250 psi	3000/250 psi	Meets requirements
Instrument Accuracy	0.3% repeatability 7 psi maximum deadband	0.25% repeatability 5.1 psi deadband	0.25% repeatability 5.2 psi deadband	Meets requirements, but need to update set-point calculation to reflect new deadband and model.
Material Compatibility with Primary Fluid	Material must not degrade or corrode in contact with primary fluid.	Primary diaphragm is kapton polyamide with an ethylene propylene rubber O-ring seal.	Primary diaphragm is 316L Stainless Steel with a welded seal.	Meets requirements; 316L Stainless Steel is acceptable.
Seismic Qualification Test Report	IEEE 344-1971 3 g horizontal 2 g vertical 5% damping Site response curve	CTE Test Report 1777-82N-C Rev. 1	CTE Test Report 1777-82N-C Rev. 1	Meets requirements; qualification maintained based on AOB document 8200-800. (See Note)
Environmental Qualification Test Report	IEEE 323-1974 120^{o}F maximum 95% humidity 10^{5} rad TAD	CTE Test Report 1777-82N-D Rev. 3	CTE Test Report 1777-82N-D Rev. 3	Meets requirements; qualification maintained based on AOB document 8200-800. (See Note)

Note: AOB document 8200-800, *Analysis of the Qualification of AOB Gauge Pressure Switches with Welded Sensor Assemblies for 1E Service,* was provided to the utility by AOB. The document was developed under the AOB Nuclear Quality Assurance program and demonstrated the conformance of the new switch configuration to the existing qualification reports. The mounting bracket is a new configuration but was determined to meet seismic qualification requirements.

As shown by Table C-1, the evaluation concluded that the replacement switch was equivalent. Further review was necessary to ascertain any related document changes that may be required, and the results are summarized in Table C-2.

Table C-2
Summary of Document Changes

Document Reviewed	Original	Replacement	Action Required
Plant Database	Model ABC-XX6	Model ABC-XX12	Update the plant CM database.
Set-Point Calculation	Deadband, maximum 7 psi, 5.1 psi	Deadband, maximum 7 psi, 5.2 psi	Revise set-point calculation to reflect new deadband and model.
Drawings	Not identified on any critical drawings	AOB Document 8200-800	Add document to the records system.
Seismic Qualification Test Report	CTE Test Report 1777-82N-C Rev. 1	CTE Test Report 1777-82N-C Rev. 1	Update the seismic configuration to reflect AOB document 8200-800.
Environmental Qualification Test Report	CTE Test Report 1777-82N-D Rev. 3	CTE Test Report 1777-82N-D Rev. 3	Update the environmental qualification data package to reflect AOB document 8200-800.

No additional changes were identified on the instrumentation or logic circuitry that required evaluation. The systems engineer responsible for the system was consulted and concurred with the suitability of the new pressure switch. The process flow, therefore, follows Figure 4-4 from this point.

C.5.5 Engineering Review Screen for Changes Within CPE (Table 4-3)

An engineering review screen (see Table 4-3) was performed to determine potential impacts on other nuclear programs. It was determined that the change potentially affected the seismic and environmental qualification programs, and that a review of current design basis analyses for instrument set points would be needed to verify that the change did not impact that analysis. The need to route the change package to the responsible engineers for each of these programs was noted and included in change package preparation.

C.5.6 Prepare Equivalent Change Package

An equivalency evaluation was prepared, reviewed, and approved to document acceptability of the alternate item. As part of this evaluation, reviews from the engineers responsible for seismic qualification, environmental qualification, and instrument set-point analysis were performed. The alternate item was found to be acceptable with no changes required to existing design basis requirements or analyses in these areas.

C.5.7 10CFR50.59 Screen

The 10CFR50.59 screen was performed, and it was determined that the change did not adversely affect the design function or the method of performing the design function of the pressure switch.

C.5.8 10CFR50.71 Screen

A screen was performed to determine whether the change affected descriptions included in the UFSAR. The affected pressure switches are not described in the UFSAR, and no revision is necessary as a result of this change.

C.5.9 Hardware Change?

This engineering change results in physical changes to plant SSCs and associated design documents.

C.5.10 Implement Hardware Change

A maintenance work order was prepared as the means to implement this equivalent change. The work in the field was completed as part of the online maintenance program, and a post-maintenance functional test to verify the work was correctly performed.

C.5.11 Turnover to Operations

Operations turnover was performed for this change in accordance with the applicable corrective maintenance procedures.

C.5.12 Closeout

Drawing change notices indicating the as-built configuration change were submitted to document control. No high priority drawings were affected, and the DCNs were incorporated at the next revision of the affected drawings.

C.6 Equivalent Change Resulting in Hardware Changes to SSCs (Reroute Thermocouple Leads)

This example differs from the example in Section C.4 because, in this example, a physical change is necessary. For this example, refer to the flowcharts provided in Figures 4-1 and 4-4.

C.6.1 Need for the Engineering Change Established

A thermocouple providing an emergency diesel generator lube oil temperature input signal has failed. Maintenance has determined that the cause is an open circuit in the leads from the thermocouple to the terminal block at which the signal is picked up for input to the temperature indicator. An engineering request was forwarded by maintenance to engineering to evaluate the acceptability of re-terminating the leads from the temperature indicator to pick up the installed spare set of leads from the thermocouple and isolate the failed set of leads.

C.6.2 CPE?

The thermocouple is part of the emergency diesel generator control circuit, which is classified as safety-related. Therefore, this change affects CPE.

C.6.3 Administrative Document-Only Change?

This change will result in a change in plant configuration and is, therefore, not an administrative document-only change.

C.6.4 Equivalent Change?

The change proposed was evaluated by engineering to determine whether it could be performed as an equivalent change or whether it constituted a design change. The installed thermocouple included two sets of output signal leads: the one connected to the temperature indicator during original plant construction (connected to terminals 1 and 2 of the associated terminal block), and an installed spare set of leads (connected to terminals 3 and 4 of the associated terminal block). The change requested would remove the leads from the temperature indicator from terminals 1 and 2 and reconnect them to terminals 3 and 4, picking up the spare set of leads from the thermocouple. The engineering review indicated that this change is allowed within the current design and licensing basis for the plant and that it results in an alternate configuration that is equivalent to the original configuration. The functional performance of the thermocouple and temperature indicator is not altered in any way. The process flow, therefore, follows Figure 4-4 from this point.

C.6.5 Engineering Review Screen for Changes Within CPE (Table 4-3)

An engineering review screen (see Table 4-3) was performed to determine whether the change proposed affected any other nuclear-related programs. The only potential impacts of this minor change were in the areas of environmental qualification and the plant fire protection analysis. The instrumentation affected is located in a mild environment zone, and it is not subject to specific environmental qualification requirements. In addition, both sets of thermocouple leads are routed in the same conduit to the terminal block, so the change has no impact on the fire protection safe shutdown analysis. No detailed reviews for impacts on other programs were required.

C.6.6 Prepare Equivalent Change Package

An equivalency evaluation was prepared, reviewed, and approved to document the acceptability of the alternate item.

C.6.7 10CFR50.59 Screen

The 10CFR50.59 screen was performed, and it was determined that the change did not adversely affect the design function or the method of performing the design function of the thermocouple or diesel engine lube oil system.

C.6.8 10CFR50.71 Screen

A 10CFR50.71 screen was performed to determine whether the change affected descriptions included in the UFSAR. The affected thermocouple and temperature indicator wiring is not described in the UFSAR, and no revision is necessary as a result of this change.

C.6.9 Hardware Change?

This engineering change results in physical changes to plant SSCs and associated design documents.

C.6.10 Implement Hardware Change

A maintenance work order was prepared as the means to implement this equivalent change. The work in the field was completed as part of the online maintenance program and a post-maintenance functional test to verify the work was correctly performed.

C.6.11 Turnover to Operations

Operations turnover was performed for this change in accordance with the applicable corrective maintenance procedures.

C.6.12 Closeout

Drawing change notices indicating the as-built configuration change were submitted to document control. No high priority drawings were affected, and the DCNs were incorporated at the next revision of the affected drawings.

C.7 Design Change Resulting in a Document-Only Change (Pressure Locking)

For this example, refer to the flowcharts provided in Figures 4-1 and 4-5.

C.7.1 Need for the Engineering Change Established

A Generic Letter issued by the NRC has identified that some gate valves experience pressure locking. Applications susceptible to this phenomenon are the LPCI injection valves and the containment cooling isolation valves. The pressure locking phenomenon will be resolved by analysis and the possible addition/replacement of some components. An engineering service order was transmitted to the design engineering, requesting an evaluation.

C.7.2 CPE?

These valves are classified as safety-related items and are considered CPE.

C.7.3 Administrative Document-Only Change?

Since the change involves the reanalysis of all gate valves to determine whether the existing motors have sufficient capacity to overcome the pressure locking, it is not considered an administrative document-only change.

C.7.4 Equivalent Change?

The reanalysis of these components will modify bounded technical requirements affecting the existing design basis. Therefore, the engineering change cannot be processed as an equivalent change but must be processed as a design change. The process flow, therefore, follows Figure 4-5 from this point.

C.7.5 Perform Engineering Change Scoping Screen (Table 4-1)

An engineering change scoping screen (See Table 4-1) identified the engineering disciplines that need ed to be involved in revising the original calculations to accommodate the new forces necessary to overcome the pressure locking.

C.7.6 Engineering Review Screen For Changes Within CPE (Table 4-3)

An engineering review screen (see Table 4-3) identified the need to provide documented and approved design input and independent design verification. The screen also identified potential impact in the following areas:

- Item 4, equipment qualification
- Item 6, system interaction evaluation
- Item 12, 10CFR50 Appendix B requirements

C.7.7 Develop Design Change Package

All of the affected calculations were revised to consider the pressure locking force. A design change package was developed that included the following basic elements:

- Design change summary
- 10CFR50.59 and 10CFR50.71 reviews
- Electrical load analysis
- Design calculations
- Affected hanger/supports
- UFSAR updates

C.7.8 10CFR50.59 and 10CFR50.71 Screens

The screening of this change identified a need to perform a safety evaluation and a UFSAR change.

C.7.9 Hardware Change?

No hardware changes were found to be necessary to accommodate the additional forces.

C.7.10 Implement Document-Only Change

This engineering change was processed as a design change resulting in document-only changes.

C.7.11 Turnover to Operations

This engineering change did not require turnover of any equipment to operations.

C.7.12 Closeout

The design calculations were submitted to plant records, and a UFSAR update request was filed.

C.8 Design Change Resulting in a Document-Only Change (Service Water Flow Rate Reduction)

For this example, refer to the flowcharts provided in Figures 4-1 and 4-5.

C.8.1 Need for the Engineering Change Established

Erosion/corrosion concerns dictated the need to reduce the available cooling water flow rates of the service water system (SWS) and the essential service water system (ESWS). The SWS is a non-safety-related system with a small group of safety-related components that supply cooling water to the safety-related ESWS. Design cooling requirements and associated margins were provided for various components in the plant design. To provide sufficient flow margins to ensure that adequate cooling was available for all components, a reduction in the flow rate from ESWS to the containment cooling system (CCS) would be required. An analysis of the effects to the plant design was determined to be necessary.

C.8.2 CPE?

The SWS and ESWS provide cooling water to both safety-related and non-safety-related equipment in the plant for heat removal. Much of the supplied equipment, such as the CCS, is required for design basis event mitigation and prevention. Since that equipment was listed on the plant Q-list, the proposed engineering change was considered to affect CPE.

C.8.3 Administrative Document-Only Change?

Since analysis is required to determine the effects of reduced cooling water flow rate to the CCS containment coolers, the change is not considered an administrative document-only design change.

C.8.4 Equivalent Change?

Reduction of the cooling water flow rate to the CCS in post-accident alignment by 50% was analyzed using plant-specific data and contemporary computer codes. The specification for CCS requires a minimum ESW flow of 4000 gallons per minute (gpm). This change would reduce the minimum ESW flow requirement to 2000 gpm. Because the change modified the bounded technical requirements (flow rate) of the SWS and ESWS, the change could not be considered equivalent. Therefore, the change was processed as a design change, and the process flow follows Figure 4-5 from this point.

C.8.5 Perform Engineering Change Scoping Screen (Table 4-1)

The engineering change scoping screen (see Table 4-1) indicated that no other engineering discipline reviews were warranted, field walkdowns would not be necessary, and a conceptual design was not feasible.

C.8.6 Engineering Review Screen for Changes Within CPE (Table 4-3)

The engineering review screen (see Table 4-3) was applied, and the following items were identified as areas of potential impact:

- Item 2, accident interaction evaluation
- Item 4, equipment qualification
- Item 5, external accident mitigation
- Item 6, system interaction evaluation
- Item 7, fire protection analysis
- Item 9, program impact review (erosion/corrosion and ISI)
- Item 12, 10CFR50 Appendix B requirements

C.8.7 Develop Design Change Package

A design change package was developed that included the following basic elements:

- Design change summary
- 10CFR50.59 and 10CFR50.71 reviews
- Flow rate and heat transfer analyses
- Design calculations
- UFSAR updates
- Q-list updates
- Revisions to the CCS specification
- Revisions to CCS operating procedures
- Revisions to design drawings

C.8.8 10CFR50.59 and 10CFR50.71 Screens

The reanalysis demonstrated the conservatism in the original safety analysis and supported the adequacy of the CCS with the reduced ESWS flow rates. The reduction of the minimum required cooling water flow rate to the containment coolers did not significantly impact the containment pressure and temperature response. Relevant design limits continued to be satisfied and no hardware changes were required.

The areas of concern were addressed in documented reviews by the appropriate engineering departments. No adverse impact was identified, and the safety evaluation determined that no unreviewed safety question existed.

C.8.9 Hardware Change?

Since no hardware changes were involved, the change was categorized as a document-only design change.

C.8.10 Implement Document-Only Change

An engineering change package was completed to revise documents for the reduced cooling water flow rate. The operating procedures were updated and revised. Training was implemented as identified in the design package.

C.8.11 Turnover to Operations

This engineering change did not require turnover of any equipment to operations.

C.8.12 Closeout

The revised design documents were submitted to plant records, and requests were filed to update the UFSAR and Q-list.

C.9 Design Change (Installation of Spectacle Flange in Fuel Transfer Canal Fill Line)

For this example, refer to the flowcharts provided in Figures 4-1 and 4-5.

C.9.1 Need for the Engineering Change Established

During a refueling outage, local leak rate tests (LLRTs) are performed on all valves that provide containment isolation. The LLRT on one of the isolation valves for the fuel transfer canal fill line failed due to excessive leakage. No spare valves were available, and maintenance of the valves was not successful.

An engineering action request (EAR) was transmitted from the group responsible for LLRT performance to design engineering. The EAR requested a design package to install a spectacle flange between the failed valve and the containment penetration. The design change was authorized by the plant manager as emergent work required for installation prior to system heat-up. The scope of work consisted of the installation of two 8-in. diameter weld neck flanges and a spectacle flange.

C.9.2 CPE?

The fuel transfer canal fill is considered part of the spent fuel cooling system, which is classified as safety-related. Therefore, this line was considered to be within CPE.

C.9.3 Administrative Document-Only Change?

Since the change involves the addition of weld neck flanges and a spectacle flange, the change is not considered an administrative document-only change.

C.9.4 Equivalent Change?

The addition of the flanges will add new components to the affected line and impact how the containment isolation function is accomplished. Because bounded technical requirements of the piping system will be modified as this change is processed, the engineering change cannot be considered equivalent. The process flow, therefore, follows Figure 4-5 from this point.

C.9.5 Perform Engineering Change Scoping Screen (Table 4-1)

Due to the urgent need for a quick resolution and the limited number of available solutions, an alternate solutions report and a conceptual design report were determined unnecessary for this change. The design change involved only the mechanical engineering discipline, and an interdisciplinary review was waived. Because the installation was within the reactor building in a congested, radiologically controlled area, a constructability walkdown was performed before developing the design change.

C.9.6 Engineering Review Screen for Changes Within CPE (Table 4-3)

The responsible engineer reviewed the requirements of this hardware design change against the criteria listed in Table 4-3. The engineer identified potential adverse impacts in the following areas:

- Item 1, ALARA impact
- Item 6, system interaction evaluation
- Item 9, program impact review

C.9.7 Develop Design Change Package

A design change package was developed that included the following basic elements:

- Design change summary
- 10CFR50.59 safety evaluation
- ALARA review
- Design evaluation
- Component classification
- Design drawings
- Design calculations
- Material procurement information
- 10CFR50 Appendix J program review
- ANSI N45.2.11 requirements

The review/approval cycle for this design change package was limited to the design engineer, independent reviewer, supervisor, manager, modifications group, quality group, plant operating review committee, and plant manager.

C.9.8 10CFR50.59 and 10CFR50.71 Screens

The screens were performed, and it was determined that a safety evaluation was needed and a change to the UFSAR would have to be processed.

C.9.9 Hardware Change?

The installation of the spectacle flange modified existing equipment, and thus resulted in changes to both hardware and the associated design documents.

C.9.10 Implement Hardware Change

The design change package was implemented and tested.

C.9.11 Turnover to Operations

A critical P&ID was revised and issued prior to turnover to operations. Because this P&ID was contained in the UFSAR, a UFSAR change was processed. The modified equipment was turned over to operations in approximately three days.

C.9.12 Closeout

The design package was processed for closeout, and the document update was processed as follows:

- Isometric drawings were considered a lower priority and were updated within 180 days of turnover to operations.
- A new component identification number was assigned to the spectacle flange, which required updating of the component database within 30 days of turnover to operations.

C.10 Comprehensive Design Change (Salt-Water Service System Replacement)

For this example, refer to the flowcharts provided in Figures 4-1 and 4-5.

C.10.1 Need for the Engineering Change Established

Numerous leaks caused by erosion/corrosion and significantly decreased pipe wall thickness throughout the system indicated that the salt-water service system needed replacement from the intake structure to the reactor building. This system is a part of the ultimate heat sink credited in the UFSAR, and it is, for the most part, underground.

Several aspects of the modification were cause for concern:

- The replacement pipe would be titanium, and an approved supplier does not exist.
- The replacement would be completed on-line without interruption to power generation. Critical activities that could be performed only with the plant down would be accomplished during normally scheduled outages.

- For a certain period of time, the underground piping would have to be exposed.
- The pipe would be rerouted, requiring a new seismic evaluation using a more conservative seismic response curve.

C.10.2 CPE?

The salt-water service system is a safety-related system and therefore is within CPE.

C.10.3 Administrative Document-Only Change?

This engineering change will result in significant modifications to plant SSCs and their associated design output documents. Therefore, the change is not an administrative document-only change.

C.10.4 Equivalent Change?

This engineering change will modify numerous technical requirements bounded by the design basis of the salt-water service system. The change will modify piping specifications, flow requirements, and structural requirements. Therefore, the change cannot be considered an equivalent change and must be processed as a design change. The process flow, therefore, follows Figure 4-5 from this point.

C.10.5 Perform Engineering Change Scoping Screen (Table 4-1)

The responsible engineers performed an engineering change scoping screen using the decision criteria in Table 4-1. They determined the following:

- There were multiple solutions, some of which could be more cost effective than others. On this basis, an alternate solutions report was recommended.
- This modification would involve significant new engineering analysis and complex logistical support. On this basis, a conceptual design report was recommended.
- The design involved many engineering disciplines. On this basis, a project plan was developed that included an interdisciplinary review team and the requirement for maintainability, constructability, and operability reviews.
- Because the pipe material could not be procured from a qualified vendor, and the installation would require detailed inspections at certain hold points, QA and QC were advised and placed on all project distribution.

C.10.6 Engineering Review Screen for Changes Within CPE (Table 4-3)

The responsible engineers reviewed the requirements of the design change against the decision criteria contained in Table 4-3. They indicated the potential for adverse program impacts in the following areas:

- Item 2, accident interaction evaluation
- Item 4, equipment qualification
- Item 5, external accident mitigation
- Item 6, system interaction evaluation
- Item 9, program impact review (in erosion/corrosion area)

In addition, the questions regarding ANSI N45.2.11 and 10CFR50.59 were answered affirmatively, which led to the need for documented and approved design input, an independent design verification, and the preparation of a safety evaluation.

C.10.7 Develop Design Change Package

The package was developed with specific evaluation performed and documented in the five areas identified. The design change package included provisions for revisions to design calculations, design drawings, and seismic qualification reports.

C.10.8 10CFR50.59 and 10CFR50.71 Screens

The screens were performed, and it was determined that a safety evaluation was needed and a change to the UFSAR would have to be processed.

C.10.9 Hardware Change?

New piping will be installed; therefore, this engineering change resulted in changes to both hardware and associated design documents.

C.10.10 Implement Hardware Change

The design change was implemented and tested in accordance with the design change package.

C.10.11 Turnover to Operations

The installation was performed while the plant remained on-line and, when completed, was turned over to operations.

C.10.12 Closeout

The design package was then processed for closeout and document update was accomplished.

C.11 Generic Engineering Change Resulting in Hardware Changes to SSCs (Solenoid Valves)

For this example, refer to the flowcharts provided in Figures 4-1 and 4-4.

C.11.1 Need for the Engineering Change Established

A generic replacement is required for an obsolete solenoid valve used in various air system applications throughout the plant. ARCO model NPZ 12345 is no longer manufactured and is being replaced by the manufacturer with ARCO model NPZ 98765.

C.11.2 CPE?

The replacement valve will be used in numerous applications throughout the plant, including the service and instrument air systems, which are CPE.

C.11.3 Administrative Document-Only Change?

This change will result in a change to the plant configuration and is, therefore, not an administrative document-only change.

C.11.4 Equivalent Change?

A review was conducted to determine the equivalency of the alternate replacement valve. The results of that review are summarized in Table C-3.

Table C-3
Equivalency Review

Design Basis Attribute	Required Value	Original Equipment	Replacement Equipment	Evaluation Results
Weight	<10 lb	5-1/2 lb	5-1/2 lb	Meets requirements
Voltage	125 Vdc	125 Vdc	125 Vdc	Meets requirements
Pipe Size	3/8 in.	3/8 in.	3/8 in.	Meets requirements
Orifice Size	5/8 in.	5/8 in.	5/8 in.	Meets requirements
Min. Operating Pressure	10 psi	10 psi	10 psi	Meets requirements
Max. Operating Pressure	150 psi	180 psi	150 psi	Meets requirements (See Note)
Safe Working Pressure	200 psi	250 psi	250 psi	Meets requirements
Max. Fluid Temperature	120°F	180°F	150°F	Meets requirements
Cv Flow Factor	3	3	3	Meets requirements
Watt Rating	<18.2	16.3	17.4	Meets requirements
Coil Insulation Class	H	H	H	Meets requirements
Ambient Temperature	40–120°F	32–140°F	32–120°F	Meets requirements

Note: These replacements are not approved for use in the emergency diesel generator air start system, because operating pressures exceed the ratings of the alternate replacement valves.

The evaluation concluded that the alternate solenoid valves were equivalent to the original. The process flow, therefore, follows Figure 4-4 from this point.

C.11.5 Engineering Review Screen for Changes Within CPE (Table 4-3)

An engineering review screen (see Table 4-3) was performed to determine whether the proposed change impacted any other nuclear related programs. The only potential impacts of this minor change were in the area of environmental qualification. The change package was routed to the EQ group for review and approval. That review concluded that the replacement valves meet the requirements of IEEE 323-1974 and have been tested as documented in ARCO EQ report EQZ-98765. The test envelope bounds the qualification criteria for all potential applications of these valves at the plant. No detailed reviews for impacts on other programs were required.

C.11.6 Prepare Generic Change Package

A generic engineering change package was prepared to allow installation of the replacement valve on an as-needed basis in applications other than the diesel air start system.

C.11.7 10CFR50.59 Screen

The 10CFR50.59 screen was performed, and it was determined that the change did not adversely affect the design function or the method of performing the design function of the solenoid valve.

C.11.8 10CFR50.71 Screen

10CFR50.71 reviews will be conducted on a case-by-case basis for each installation.

C.11.9 Hardware Change?

This change is processed to accommodate an equivalent alternate valve. Thus, this engineering change results in changes to plant hardware and associated design documents.

C.11.10 Implement Generic Hardware Change

Implementation will be performed through the use of maintenance requests as needed.

C.11.11 Turnover to Operations

Operations turnover will be performed in accordance with maintenance work procedures.

C.11.12 Closeout

The engineering change was closed. Affected controlled documents will be updated on a case-by-case basis as part of the implementation process, and the necessary changes will be implemented through the drawing control system. Individual replacement activities will be closed out with each maintenance request.

D
EXAMPLE OF A DOCUMENT UPDATE

Different philosophies will influence how prioritization of drawing revisions is managed by different utilities. This appendix provides an approach in which drawings are prioritized by importance to site organizations for operations and operations support.

The following drawings, documents, databases, and procedures cover safety-related and quality-related equipment.

Priority 1 (Close out before turnover and prior to operability)

Operator-significant drawings

- P&ID/flow diagrams
- Vendor P&ID/flow diagrams

Technical databases

Operating procedures

Operations training conducted

Test document reviews

Field changes

Calculations assessed for impacts

Priority 2 (Within 14 days of receipt of operability notification)

Operator-significant drawings

- Control wiring diagrams
- Safeguard material for power block
- In-service inspection isometric
- Mechanical arrangement of fire barrier penetrations

- Fire barrier penetration list
- Floor and wall sleeve drawings
- In-service inspection hanger isometric

Fuse schedule (if applicable to the utility)

Priority 3

Maintenance procedures (within 90 days of operability notification)

Maintenance-significant drawings (drawing to be revised when there are two open changes outstanding or when there is one open change outstanding for one month)

- Electrical arrangement fire protective covering
- Single-line diagrams
- Three-line diagrams
- Motor control centers
- Annunciator arrangement
- General instrumentation arrangement
- Logic diagram
- Instrument schedule
- Cable diagram
- Interconnection wiring diagram
- Data acquisition system
- Safeguard material (protected area)

Priority 4

Engineering-significant drawings (drawing to be revised when there are four open changes outstanding or when there is one open change outstanding for one month)

- Equipment arrangement
- Tray and conduit layout
- Electrical penetrations
- Bill of material—electrical
- Instrument piping and supports
- Instrument rack arrangement
- Bill of material—instrumentation

- Instrument valve list
- Instrument loop diagram
- Wire list
- Pneumatic control schedule
- Safeguard material (controlled area)
- Fire protection equipment
- HVAC arrangement
- Heat balance diagram
- Bill of material—mechanical
- Valve list
- Piping isometric
- Piping schematic
- Concrete and rebar
- Structural steel
- Pipe and equipment support details
- Bill of material—structural
- Cable tray fire barrier support details
- Stress analysis isometric/diagrams
- Calculations
- Bill of material—civil

Design criteria/DBDs

Simulator upgrade

Others

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