4.2 SCREENING

~~CAUTION~~

~~The guidance contained in this appendix is intended to supplement the generic Screen guidance contained in the main body in NEI 96-07, Section 4.2. Namely, the generic Screen guidance provided in the main body of NEI 96-07 and the more focused Screen guidance in this appendix BOTH apply to digital modifications.~~

~~NOTE: In the following sections and sub-sections that describe the Screen guidance unique to the application of 10 CFR 50.59 to digital modifications, each section and sub-section describes only a specific aspect, sometimes at the deliberate exclusion of other related aspects. This focused approach is intended to concentrate on the particular aspect of interest and does not imply that the other aspects do not apply or could not be related to the aspect being addressed.~~

Once it has been determined that 10 CFR 50.59 is applicable to a proposed activity, screening is performed to determine if the activity should be evaluated against the evaluation criteria of 10 CFR 50.59(c)(2). While digital I&C systems have particular design characteristics, such as those described in Section 1.1.1, not all ~~3.1 INTRODUCTION There is no regulatory or technical requirement for a~~ proposed activities~~y~~ involving a digital modification would "screen in" as ~~to *default* (i.e., be mandatorily "forced") to~~ having an adverse effect on ~~how~~ an UFSAR-described design function. ~~is performed or controlled. The introduction of software or digital hardware, in and of itself, does not cause the proposed activity to be adverse (i.e., "screen in"). Likewise, simply because software and/or digital hardware is replaced with other software and/or digital hardware does not cause the proposed activity to be adverse.~~

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

Commented [BD1]: The body of NEI 96-07r1 is the baseline guidance for applying 50.59 for all systems that contains numerous subtle details that must be considered. This document is a standalone document that repeats relevant text from NEI 96-07r1. This approach also has an important benefit of ensuring digital systems are not treated differently than other systems.

Commented [BD2]: Note: NEI's proposed wording of "fundamental change" goes beyond "Introduction" type wording and was moved to Section 4.2.1.2 where fundamental change is discussed. .

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 10 CFR 50.59. Activities that are screened out from further evaluation under 10 CFR 50.59 should be documented as discussed in Section 4.2.3.

Each element of a proposed activity must be screened except in instances where linking elements of an activity is appropriate, in which case the linked elements can be considered together. A test for linking elements of proposed changes is interdependence.

It is appropriate for discrete elements to be considered together if (1) they are interdependent as in the case where a modification to a system or component necessitates additional changes to other systems or procedures; or (2) they are performed collectively to address a design or operational issue. For example, a digital ~~pump upgrade~~ modification may also necessitate a change to a support system, such as heating, and air conditioning to maintain the required environmental conditions in the areas containing digital equipment~~cooling water~~.

If concurrent changes are being made that are not linked, each must be screened separately and independently of each other.

Activities that screen out may nonetheless require UFSAR information to be updated. Licensees should provide updated UFSAR information to the NRC in accordance with 10 CFR 50.71(e).

Specific guidance for applying 10 CFR 50.59 to temporary changes proposed as compensatory actions for degraded or nonconforming conditions is provided in Section 4.4 of NEI 96-07, Revision 1.

4.2.1 Is the Activity a Change to the Facility or Procedures as Described in the UFSAR?

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 thorough 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 a 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, e.g., alter equipment access or add steps necessary for performing tasks?
- Does the activity degrade the seismic or environmental qualification of the SSC?
- 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.

Per the definition of "change" discussed in Section 3.3, 10 CFR 50.59 is applicable to additions as well as to changes to and removals from the facility or procedures. Additions should be screened for their effects on the existing facility and procedures as described in the UFSAR and, if required, a 10 CFR 50.59 evaluation should be performed. For example, 10 CFR 50.59 is applicable to changes the facility (e.g., replacement of an analog control system with a digital control system) as well as to additions to the facility (e.g., additional piping with a digitally-controlled valve) and should be screened for their effects on the existing facility and procedures UFSAR. NEI 98-03 provides guidance for determining whether additions to the facility and procedures should be reflected in the UFSAR per 10 CFR 50.71(e).

Consistent with historical practice, changes affecting SSCs or functions not described in the UFSAR must be screened for their effects (so-called "indirect effects") on UFSAR-described design functions. A 10 CFR 50.59 evaluation is required when such changes adversely affect a UFSAR-described design function, as described below.

Screening for Adverse Effects

A 10 CFR 50.59 evaluation is required for changes that adversely affect design functions, methods used to perform or control design functions, or evaluations that demonstrate that intended design functions will be accomplished (i.e., "adverse changes"). Changes that have none of these effects, or have positive effects, may be screened out because only adverse changes have the potential to increase the likelihood of malfunctions, increase consequences, create new accidents or otherwise meet the 10 CFR 50.59 evaluation criteria.[1]

Per the definition of "design function," SSCs may have preventive, as well as mitigative, design functions. Adverse changes to either must be screened in. Thus a change that decreases the reliability of a function whose failure could initiate an accident would be considered to adversely affect a design function and would screen in. In this regard, changes that would relax the manner in which Code requirements are met for certain SSCs should be screened for adverse effects on design function. Similarly, changes that would introduce a new type of accident or malfunction would screen in. This reflects an overlap between the technical/engineering ("safety") review of the change and 10 CFR 50.59. This overlap reflects that these considerations are important to both the safety and regulatory reviews.

~~3.2.1.1 DEPENDABILITY~~

~~In the main body of NEI 96-07, Section 4.2.1, subsection titled "Screening for Adverse Effects," reliability is mentioned in the following excerpt:~~

> ~~"...a change that decreases the reliability of a [design] function whose failure could initiate an accident would be considered to adversely affect a design function..."~~

~~For digital modifications, the most commonly used term to describe this concept is "dependability." To address dependability of a design function for an activity involving a digital modification, the following tools may be used:~~

- ~~Operating History of the Hardware and/or Software~~

[1] Note that as discussed in Section 4.2.1.1, any change that alters a design basis limit for a fission product barrier—positively or negatively—is considered adverse and must be screened in.

Commented [BD3]: NEI's proposed wording in the next paragraph refers to this sentence.

Commented [BD4]: This sentence is from above paragraph from NEI 96-07r1 main body (and repeated in this document). The next sentence provides the intended context as
"**In this regard**, changes that would relax the manner in which Code requirements are met for certain SSCs should be screened for adverse effects on design function."
Section 4.2.1.1 details that software is considered adverse. Thus, NEI's proposed wording regarding "dependability" relates to the magnitude of the adverse effect and would discussed in the required 50.59 evaluation.
" .

- ~~Development (including design attributes and the process), Testability, Verification & Validation (V&V), and Configuration Management of the Hardware and/or Software~~
- ~~Design Measures (including data validation, cyclic software architecture, internal redundancy, etc.).~~

~~To address dependability, the Screen should contain a discussion of the information (including the identification of associated references) gathered from applying the tools identified above.~~

~~Typically, digital equipment is more reliable than the equipment it replaces and often incorporates design features that contribute to a lower likelihood of malfunction. Such features can improve the dependability of a train of a system; thus preserving the system level design function. These features should be identified in the response to this Screen consideration, and may include discussions of the following attributes and/or characteristics:~~

- ~~Internal redundancy and fault tolerance to preclude single faults from causing the device to malfunction.~~
- ~~Self-diagnostics to detect and alarm faults, or abnormal or unanticipated conditions so that operators can take timely corrective action before the system is called upon to perform its design function.~~
- ~~Self-test routines that perform surveillance testing functions on a more frequent basis than the original, manually executed surveillance tests.~~
- ~~Preventive measures~~
- ~~System performance under high duty cycle loading (e.g., computational burden during accident conditions).~~
- ~~Availability of a means to alert the operators to the failure condition.~~

If a change has both positive and adverse effects, the change should be screened in. The 10 CFR 50.59 evaluation should focus on the adverse effects.

The screening process is not concerned with the magnitude of adverse effects that are identified. Any change that adversely affects a UFSAR-described design function, method of performing or controlling design functions, or evaluation that demonstrates that intended design functions will be accomplished is screened in. The magnitude of the adverse effect (e.g., is the minimal increase standard met?) is the focus of the 10 CFR 50.59 evaluation process.

Screening determinations are made based on the engineering/technical

information supporting the change. The screening focus on design functions, etc., ensures the essential distinction between (1) 10 CFR 50.59 screenings, and (2) 10 CFR 50.59 evaluations, which focus on whether changes meet any of the eight criteria in 10 CFR 50.59(c)(2). Technical/engineering information, e.g., design evaluations, etc., that demonstrates changes have no adverse effect on UFSAR-described design functions, methods of performing or controlling design functions, or evaluations that demonstrate that intended design functions will be accomplished may be used as basis for screening out the change. If the effect of a change is such that existing safety analyses would no longer be bounding and therefore UFSAR safety analyses must be re-run to demonstrate that all required safety functions and design requirements are met, the change is considered to be adverse and must be screened in. The revised safety analyses may be used in support of the required 10 CFR 50.59 evaluation of such changes.

Changes that entail update of safety analyses to reflect improved performance, capacity, timing, etc., resulting from a change (beneficial effects on design functions) are not considered adverse and need not be screened in, even though the change calls for safety analyses to be updated. For example, a change involving a digital controller that improves the closure time of main control room isolation dampers reduces the calculated dose to operators, and UFSAR dose consequence analyses are to be updated as a result. In this case, the dose analyses are being revised to reflect the lower dose for the main control room, not to demonstrate that GDC limits continue to be met. A change that would adversely affect the design function of the dampers (post-accident isolation of the main control room) and increase the existing calculated dose to operators would be considered adverse and would screen in. In this case, the dose analyses must be re-run to ensure that GDC limits continue to be met. The revised analyses would be used in support of the 10 CFR 50.59 evaluation to determine if the increase exceeds the minimal standard and requires prior NRC approval.

To further illustrate the distinction between 10 CFR 50.59 screening and evaluation, consider the example of a change to a diesel generator-starting relay that delays the diesel start time from 10 seconds to 12 seconds. The UFSAR-described design function credited in the ECCS analyses is for the diesel to start within 12 seconds. This change would screen out because it is apparent that the change will not adversely affect the diesel generator design function credited in the ECCS analyses (ECCS analyses remain valid).

However, a change that would delay the diesel's start time to 13 seconds would screen in because the change adversely effects the design function (to start in 12 seconds). Such a change would screen in even if technical/engineering information supporting the change includes revised

safety analyses that demonstrate all required safety functions supported by the diesel, e.g., core heat removal, containment isolation, containment cooling, etc., are satisfied and that applicable dose limits continue to be met. While this change may be acceptable with respect to performance of required safety functions and meeting design requirements, the analyses necessary to demonstrate acceptability are beyond the scope/intent of 10 CFR 50.59 screening reviews. Thus a 10 CFR 50.59 evaluation would be required. The revised safety analyses would be used in support of the 10 CFR 50.59 evaluation to determine whether any of the evaluation criteria are met such that prior NRC approval is required for the change.

Additional specific guidance for identifying adverse effects due to a procedure or methodology change is provided in subsections 4.2.1.2 and 4.2.1.3, respectively.

4.2.1.1 Screening of Changes to the Facility as Described in the UFSAR

Screening to determine that a 10 CFR 50.59 evaluation is required is straightforward when a change adversely affects an SSC design function, method of performing or controlling a design function, or evaluation that demonstrates intended design functions will be accomplished as described in the UFSAR.

However, a facility also contains many SSCs not described in the UFSAR. These can be components, subcomponents of larger components or even entire systems. Changes affecting SSCs that are not explicitly described in the UFSAR can have the potential to adversely affect SSC design functions that are described and thus may require a 10 CFR 50.59 evaluation. In such cases, the approach for determining whether a change involves a change to the facility as described in the UFSAR is to consider the larger, UFSAR-described SSC of which the SSC being modified is a part. If for the larger SSC, the change adversely affects a UFSAR-described design function, method of performing or controlling the design function, or an evaluation demonstrating that intended design functions will be accomplished, then a 10 CFR 50.59 evaluation is required.

Another important consideration is that a change to nonsafety-related SSCs not described in the UFSAR can indirectly affect the capability of SSCs to perform their UFSAR-described design function(s). For example, increasing the heat load on a non safety-related heat exchanger could compromise the cooling system's ability to cool safety-related equipment.

Seismic qualification, missile protection, flooding protection, fire protection, environmental qualification, high energy line break and masonry block walls are some of the areas where changes to nonsafety-related SSCs, whether or

not described in the UFSAR, can affect the UFSAR-described design function of SSCs through indirect or secondary effects.

Identical replacements are considered a maintenance activity, not a plant design change and are not subject to 10 CFR 50.59. When replacing a plant component with a similar, but not identical replacement, the ~~L~~licensee may perform an equivalence assessment~~s~~ that considers ~~, e.g., consideration of~~ performance/operating characteristics and other factors to determine if the component can be considered an equivalent replacement that can be performed as a maintenance activity or if the replacement is a change to the facility subject to 10 CFR 50.59.

While analog-to-digital changes would never be considered an equivalent replacement, ~~F~~for digital-to digital changes that appear to be an equivalent replacement ~~like-for-like replacements~~, the licensee may perform an equivalency evaluation. ~~should be performed to determine if the replacement is a plant design change (subject to 10 CFR 50.59) versus a maintenance activity.~~ Digital-to-digital changes may not necessarily be equivalent ~~like-for-like~~ because the system behaviors, response time, failure modes, etc. for the new system may be different from the old system. If the vendor, hardware, firmware, application software, and configuration data are identical, then the change may be an equivalent replacement~~a like-for-like~~ maintenance activity where 10 CFR 50.59 would not apply.

As discussed in Section 4.2.1, only proposed changes to SSCs that would, based on supporting engineering and technical information, have adverse effects on design functions require evaluation under 10 CFR 50.59. Changes that have positive or no effect on design functions may generally be screened out. In addition, any change to a design bases limit for a fission product barrier must be considered adverse and screened in. This is because 10 CFR 50.59(c)(2)(vii) requires prior NRC approval any time a proposed change would "exceed *or alter*" a design bases limit for a fission product barrier.

Software Considerations in the Screening Process

With respect to screening digital modifications~~upgrades~~, one important question is whether adverse effects are created by software. For the reasons described in Section 1.1.1 of this guidance, except for a simple system described below, ~~An~~ changes to facility involving software should be treated as "adverse" due to ~~adverse effect may be~~ the potential marginal increase in likelihood of failure. ~~due to the introduction of software.~~ For redundant ~~safety~~ systems, this marginal increase in likelihood due to software creates a similar marginal increase in the likelihood of a common failure in redundant channels. On this basis, most changes to the facility involving software

~~digital upgrades to redundant safety systems~~ should be ~~conservatively~~ treated as "adverse" and screened in for further evaluation under the 10 CFR 50.59 process.

~~3.2.1.2 Types of SSCs~~

During the original licensing process, the types of SSCs in the facility may have been a consideration. In general, different SSCs may be equivalent, similar or identical to one another physically or functionally.

The UFSAR may explicitly or implicitly describe the types of SSCs through diversity, separation, independence and/or redundancy discussions. With digital modifications, the new equipment has the potential to impact the diversity, separation, independence and/or redundancy of the SSCs described in the UFSAR.

~~To assist in determining the impact of a digital modification on the diversity, separation, independence and/or redundancy of the affected components, identify the types of SSCs described in the UFSAR. Compare the proposed types of SSCs with the existing types of SSCs. The impact of any differences in the types of SSCs on diversity, separation, independence and/or redundancy is then determined.~~

~~For redundant SSCs that must satisfy single failure criteria requirements, the following guidance applies:~~

~~1. The use of exactly the same software in two or more redundant SSCs is ADVERSE because the independence of the SSCs has been reduced.~~

~~2. The use of different software in two or more redundant SSCs is NOT ADVERSE because the independence of the SSCs has been maintained.~~

~~3. The use of exactly the same or different hardware in two or more redundant SSCs is subject to the same licensing considerations as described in the UFSAR as those for non-digital SSCs and a conclusion of ADVERSE or NOT ADVERSE is determined in the same manner as for non-digital proposed activities.~~

However, some digital modifications involving software ~~relatively simple digital equipment~~are sufficiently simple that failure due to software can be eliminated from consideration if the engineering/technical information supporting the change demonstrates that every possible combination of inputs and every possible sequence of device states are tested and all outputs are verified for every case. ~~, engineering evaluations may show that the risk of failure due to software is not significant and need not be evaluated further, even in applications of high safety significance. As described in Section 5, consensus methods have been developed for evaluating dependability of digital equipment including assessment of the potential for common cause failure due to software. Overall, the ability to evaluate the dependability of~~

Commented [BD5]: As stated in the previous paragraph, for software the adverse effect is the potential marginal increase in the likelihood of failure in one or redundant channels and would screen in regardless of any impact on diversity, separation, independence, or redundancy. . Section 4.2.1 lists questions to ask including "■ Does the activity reduce existing redundancy, diversity or defense-in-depth? "

Commented [BD6]: Software is adverse because it potentially effects likelihood of a malfunction irrespective of independence.

Commented [BD7]: Incorrect. Using Identical hardware in different systems does not mean the design and licensing considerations of another system apply. .

~~digital equipment has improved over the years, as some vendors are using updated and improved processes for software and digital system development, V&V and configuration management. Also, some digital equipment has gained extensive operating history, both inside and outside the nuclear industry.Thus, for some upgrades the likelihood of failure due to software may be judged to be no greater than failure due to other causes, i.e., comparable to hardware common cause failure.~~ In such ~~a~~ cases, failure due to software can be eliminated from consideration even when it affects redundant systems in applications of high safety significance, the digital modification ~~upgrade~~ would screen out.

Other Digital Issues in the Screening Process

In addition to the software question, other characteristics of a digital ~~upgrade~~ modification could cause the change to screen in to a 10 CFR 50.59 evaluation. Some potentially adverse effects that should be evaluated when screening digital modifications ~~upgrades~~ include:

- Combining previously separate functions into one digital device such that failures create new malfunctions (i.e., multiple functions are disabled if the digital device fails).
- Changing performance from UFSAR-described requirements (e.g., for response time, accuracy, etc.).
- Changing functionality in a way that increases complexity, potentially creating new malfunctions.
- Introducing different behavior or potential failure modes (for which the risk is not negligible) that could affect the design function.

~~3.2.1.1~~ COMBINATION OF COMPONENTS/FUNCTIONS

During the original licensing process, the number of components, how the components were arranged, and/or how functions were allocated to those components, may have been a consideration that provided a level of physical and/or functional variety and/or layers of design.

When replacing analog SSCs, it is potentially advantageous to combine multiple components and/or functions into a single device or control system. However, the failure of the single device or control system for any reason (e.g., software defect, hardware failure, environmental effects, etc.) can potentially affect multiple functions.

To assist in determining the impact of a digital modification on the number and/or arrangement of components, review the description of the existing

Commented [BD8]: The above describes various potential adverse impacts of combining functions. The number of components and arraignment is captured in the first bullet above. .

system(s) and/or component(s) in the UFSAR and compare how the number and/or arrangement of components is reflected in the proposed number and/or arrangement of components. Typically, drawings included as part of the UFSAR or those considered to be *incorporated by reference* (see main body NEI 96-07, Section 3.7) will show the current configuration as having a specific number and/or a specific arrangement of components. Using the current configuration, consider how the proposed configuration affects the number and/or arrangement of components.

If the combination of components and/or functions does not involve SSCs described in the UFSAR (directly or indirectly), or does not involve UFSAR-described design functions, then there cannot be an adverse impact due to the combination aspect of the digital activity.

Alternately, if the affected SSCs are described in the UFSAR and/or the design functions of the affected SSCs are described in the UFSAR, then the determination of the impact of an activity involving a digital modification that combines components and/or functions considers if the activity reduces the existing number and/or arrangement of components.

The combination of previously separate components and/or functions, in and of itself, does not make the Screen conclusion adverse. Only if combining the previously separate components and/or functions causes a reduction in the reliability of performing a design function (e.g., by the creation of a new malfunction or the creation of a new accident initiator) is the combination aspect of the digital activity adverse.

Commented [BD9]: Combining previously separate functions into one digital device such that failures create new malfunctions (i.e., multiple functions are disabled if the digital device fails) is an adverse effect irrespective of reliability.

The following examples illustrate the 10 CFR 50.59 screening process as applied to proposed facility changes:

Example 1

A licensee proposes to replace an analog ~~relay in the~~ overspeed trip circuit of an emergency diesel generator with a nonequivalent ~~relay~~digital overspeed trip circuit. The ~~relay is~~ specific components of the overspeed trip circuit are not described in the UFSAR, but the design functions of the overspeed trip circuit and the emergency diesel generator are. Based on engineering/technical information supporting the change, the licensee's 10 CFR 50.59 screening determines whether ~~if~~ replacing the overspeed trip circuit ~~relay~~ would adversely affect the design function of either the overspeed trip circuit or EDG. If the licensee concludes that the change would not adversely affect the UFSAR-described design function of the circuit or EDG, then this determination would form the basis for screening out the change, and no 10 CFR 50.59 evaluation would be required.

Example 2

A licensee proposes to modify transmitters used to drive signals for parameters monitored by redundant engineered safety feature actuation system channels by replacing the original analog transmitters with microprocessor-based transmitters. For each channel, the existing 4-20 milliamp instrument loop is maintained without any changes other than replacing the transmitter itself. The firmware in the new transmitters implements a simple process of acquiring one input signal, setting one output, and performing some simple diagnostic checks. This process runs in a continuous sequence with no branching or interrupts. The engineering/technical information supporting the change demonstrated that every possible combination of inputs and every possible sequence of device states were tested and all outputs were verified for every case. As such, the licensee determined that this digital modification involving software/firmware was sufficiently simple that failure due to software/firmware could be eliminated from consideration. The engineering/technical information also demonstrated that the new device had been developed in accordance industry standards and regulatory guidance. The engineering/technical information was used to demonstrate that the change would not adversely affect the UFSAR-described design function which formed the basis for screening out the change, and no 10 CFR 50.59 evaluation was required. ~~In addition, based on the simplicity of the device (one input and two outputs), it was easily tested. Further, substantial operating history has demonstrated high reliability in applications similar to the ESFAS application. Failures are bounded by existing failures of the analog device (see NEI 01-01 section 5.1 for further discussion of failures), and the likelihood of concurrent failures in multiple channels is considered to be very low (e.g., less than the likelihood of common mode failures due to maintenance or calibration errors), and falls within the "negligible risk" region of NEI 01-01 Figure 2. Consequently, it is concluded that no adverse effects are created and the change screens out.~~

Example 3

A licensee proposes to change involving parameters monitored by redundant reactor protection system channels to replace the original analog transmitters with microprocessor-based transmitters that ~~Smart transmitters similar to those described in Example 2 are to be installed as part of an upgrade to the reactor protection system. The new smart transmitters~~ have the capability to transmit their output signal using a digital communication protocol. Other instruments in the loop are to be replaced with units that can communicate with the transmitter using the same protocol. Because this change not only upgrades to a digital transmitter, but also converts the instrument loop to digital communications

among devices, there would be the potential for adverse effects owing to the digital communication and possible new failure modes involving multiple devices. As a result, the change adversely affect the UFSAR-described design function so the change screens in and 10 CFR 50.59 evaluation is required.~~screens in.~~

Example 4

An analog recorder is to be replaced with a new microprocessor based recorder that used software. The recorder is used for various purposes including Post Accident Monitoring, which is an UFSAR-described design function. The engineering/technical information supporting the change demonstrated that every possible combination of inputs and every possible sequence of device states were tested and all outputs were verified for every case. As such, the licensee determined that this digital modification involving software was sufficiently simple that failure due to software/firmware could be eliminated from consideration. The engineering/technical information also demonstrated that the new device had been developed in accordance industry standards and regulatory guidance. The engineering/technical information supporting the change evaluated human system interface and determined that ~~An engineering/technical evaluation performed on the change determined that the new recorder will be highly dependable (based on a quality development process, testability, and successful operating history) and therefore, the risk of failure due to software is considered very low. The new recorder also meets all current required performance, HIS, and qualification requirements and would have no new failure modes or effects at the level of the design function. The~~ operator will use the new recorder in the same way the old one was used and the same information is provided to support the Post Accident Monitoring function, the method of controlling or performing the design function is unaltered. The licensee concludes that the change will not adversely affect the design function and screens out the change.

Example 5

A resistor in a digital valve controller ~~The bolts for retaining a rupture disk are~~is being replaced with a resistor ~~bolts~~ of a different material ~~and fewer threads,~~ but equivalent resistance and voltage and current ~~load capacity and strength,~~ such that the digital valve controller ~~rupture disk~~ will still position the valve ~~relieve at~~ to the same demanded position ~~pressure~~ as before the change. Because the resistor ~~replacement bolts~~ is ~~are~~ equivalent to the original resistor~~bolts~~, the design function of the digital valve controller ~~rupture disk~~ (to position the valve to the demanded position~~relieve at a~~

~~specified pressure~~) is unaffected, and this activity may be screened out as an equivalent change.

Example 6

A licensee is planning to replace an analog recorder with a new microprocessor based recorder. The engineering/technical evaluation supporting the change determined that the new recorder does not truly record continuously. Instead, it samples at a rate of 10 hertz, then averages the 10 samples and records the average every one second. This frequency response is lower compared to the original equipment and may result in not capturing all process variable spikes or short-lived transients. In this case, the licensee concludes that there could be an adverse effect on an UFSAR-described design function and screens in the change. In the 10 CFR 50.59 evaluation, the licensee will evaluate magnitude of this adverse effect.

Example 3-3. Replacing SSC Types with NO ADVERSE IMPACT on a UFSAR-Described Design Function

A licensee has two non-safety-related main feedwater pumps (MFWPs), each with 70% capacity. There are two analog control systems, one for each MFWP, that are physically and functionally the same.

The licensee proposes to replace the two analog control systems with two digital control systems. The hardware platform for each digital control system is from the same supplier and the software in each digital control system is exactly the same.

The UFSAR descriptions are as follows:

(1) Two analog control systems exist.

(2) Both analog control systems consist of the same physical and functional characteristics.

(3) The types of MFWP control system malfunctions include (a) failures causing the loss of all feedwater to the steam generators and (b) failures causing an increase in main feedwater flow to the maximum output from both MFWPs (140%).

The use of the same hardware platforms and identical software in both control systems is NOT ADVERSE for the following reasons:

(1) There are no UFSAR descriptions related to the ability of one MFWP and its analog control system to provide a redundant source of main feedwater flow in the event of the loss of one MFWP/control system. Therefore, the MFWPs and control systems are not required to satisfy single failure criteria. The two analog control systems existed for operational convenience only, not to satisfy any General Design Criteria requirements.

Commented [BD10]: Example 3-3 would both screen in based on the above guidance which states "For the reasons described in Section 1.1.1 of this guidance, except for a simple system described below, changes to facility involving software should be treated as "adverse" due to the potential marginal increase in likelihood of failure. For redundant systems, this marginal increase in likelihood due to software creates a similar marginal increase in the likelihood of a common failure in redundant channels."

(2) There is no impact on diversity since none originally existed or was described in the UFSAR.

(3) There is no impact on the separation of the control systems described in the UFSAR since each of the analog control systems will be replaced with its own digital control system.

(4) Although both of the new digital control systems contains the exact same software (which is subject to a software CCF), no new types of malfunctions are introduced since the loss of BOTH MFWPs and failures causing an increase in main feedwater flow to the maximum output from both MFWPs (140%) are already considered in the licensing basis.

Example 3-4. Replacing SSC Types with an ADVERSE IMPACT on a UFSAR-Described Design Function

Using the same basic information from Example 3-3, this example illustrates how variations in the licensing basis as described in the UFSAR would result in ADVERSE conclusions.

Alternate Licensing Basis #1: If the UFSAR described the loss of only ONE MFWP, the proposed activity would be ADVERSE because a new type of malfunction would be introduced due to a possible software CCF that could disable BOTH MFWPs.

Alternate Licensing Basis #2: If the UFSAR described the consideration of the maximum output from only ONE MFWP, the proposed activity would be ADVERSE because a new type of malfunction would be introduced due to a possible software CCF that could cause BOTH MFWPs to reach their maximum output.

Commented [BD11]: Example 3-4 would screen in based on the above guidance which states "For the reasons described in Section 1.1.1 of this guidance, except for a simple system described below, changes to facility involving software should be treated as "adverse" due to the potential marginal increase in likelihood of failure. For redundant systems, this marginal increase in likelihood due to software creates a similar marginal increase in the likelihood of a common failure in redundant channels."

Example 3-6. Combining Components and Functions with NO ADVERSE IMPACT on a UFSAR-Described Design Function

Using the same initial facility configuration from Example 3-5, this example illustrates how a variation in the proposed activity would be addressed.

Instead of two separate, discreet, unconnected digital control systems being used for the feedwater control systems, only one central digital processor is proposed to be used that will combine the previously separate control systems and control both feedwater pumps.

Although the UFSAR explicitly describes the existence of two control systems, combining the two analog control systems into one digital control system is NOT adverse because no new malfunctions are created (i.e., recall that the loss of both control systems and maximum feedwater flows from both feedwater pumps have already been considered in the licensing basis). Since no new malfunctions are

Commented [BD12]: Example 3-6 would screen in based on the above guidance which states
Combining previously separate functions into one digital device such that failures create new malfunctions (i.e., multiple functions are disabled if the digital device fails) is an adverse effect.
And
Software Considerations
"For the reasons described in Section 1.1.1 of this guidance, except for a simple system described below, changes to facility involving software should be treated as "adverse" due to the potential marginal increase in likelihood of failure. For redundant systems, this marginal increase in likelihood due to software creates a similar marginal increase in the likelihood of a common failure in redundant channels."
And
Section 4.2.1 lists questions to ask including "■ Does the activity reduce existing redundancy, diversity or defense-in-depth? "

created, the reliability of the design function "to provide adequate cooling water to the steam generators during normal operation" is maintained.

Example 3-7. Combining Components and Functions with an ADVERSE IMPACT on a UFSAR-Described Design Function

Using the same initial facility configuration and proposed activity from Example 3-5 (i.e., the use of two digital control systems), this example illustrates how a variation in the licensing basis as described in the UFSAR impacts the Screen conclusion, causing an adverse impact.

Instead of the loss of all feedwater to the steam generators due to the loss of both analog control systems being previously considered in the licensing basis, the loss of only one analog control system (and its worst-case affect on feedwater flow) has been considered.

In this case, the proposed activity would be adverse since a new malfunction is created (i.e., loss of both control systems) due to a CCF (e.g., a software defect in both digital control systems).

Similarly, if the combination of components and functions examined in Example 3-6 was proposed (i.e., the use of only one digital control system), the proposed activity would be adverse for the same reason as above (i.e., creation of a new malfunction).

In both cases, the adverse impact is due to the reduction in the reliability of the design function "to provide adequate cooling water to the steam generators during normal operation."

Commented [CN13]: Example 3-7: NEI 96-07r1 screening section uses "adverse effects," **not** "reduction in the reliability" (which is only one of many possible adverse effects.)

Example 3-8. Combining Components and Functions with an ADVERSE IMPACT on a UFSAR-Described Design Function

Using the same initial facility configuration from Example 3-5, this example illustrates how a significant variation in the proposed activity would cause an adverse impact.

In addition to the feedwater control systems, the licensee has several non-safety-related main turbine steam-inlet valves that are controlled with a single analog control system. The main turbine steam-inlet valves analog control system has many subcomponents performing dedicated functions. However, only the main turbine steam-inlet valves control system is described in the UFSAR, not the individual components or subcomponents.

The licensee proposes to combine the feedwater control systems and the turbine steam-inlet valves control system into one digital device.

The design function for the feedwater control system from Example 3-5 remains pertinent. Since only the turbine steam-inlet control valve control system is

Commented [BD14]: This example is inconsistent with NEI 96-07r1 Section 4.2.1.1 which states:
However, a facility also contains many SSCs not described in the UFSAR. These can be components, subcomponents of larger components or even entire systems. Changes affecting SSCs that are not explicitly described in the UFSAR can have the potential to adversely affect SSC design functions that are described and thus may require a 10 CFR 50.59 evaluation. In such cases, the approach for determining whether a change involves a change to the facility as described in the UFSAR is to consider the larger, UFSAR-described SSC of which the SSC being modified is a part. If for the larger SSC, the change adversely affects a UFSAR-described design function, method of performing or controlling the design function, or an evaluation demonstrating that intended design functions will be accomplished, then a 10 CFR 50.59 evaluation is required.
Another important consideration is that a change to nonsafety-related SSCs not described in the UFSAR can indirectly affect the capability of SSCs to perform their UFSAR-described design function(s). For example, increasing the heat load on a non safety-related heat exchanger could compromise the cooling system's ability to cool safety-related equipment.

described in the UFSAR, it is the only other SSC to be examined for the identification of design functions. The turbine control system contains a design function "to control the amount of steam entering the main turbine during normal operation." This function rises to the level of a design function because, if not performed, the inability to control steam to the main turbine would initiate an accident (i.e., Excess Steam Demand or Loss of Load).

The loss of all feedwater to the steam generators due to the loss of both analog control systems has been previously considered in the licensing basis (i.e., the Loss of Feedwater accident).

The failure of all the steam-inlet valves (e.g., all valves going fully closed or all valves going fully open) due to the loss of the analog control system has been considered in the licensing basis, as follows: "all open" is considered in the Excess Steam Demand accident and "all closed" is considered in the Loss of Load accident. However, the licensing basis does not consider the combination of the Loss of Feedwater accident with either the Excess Steam Demand accident or the Loss of Load accident.

In this case, the proposed activity would be adverse because a new malfunction has been created (i.e., loss of both feedwater control systems and the loss of the turbine control system) that was not previously considered in the licensing basis.

Furthermore, the combination of the different control systems causes a reduction in the separation described in the UFSAR.

These impacts have an adverse impact on reliability of the feedwater control system design function "to provide adequate cooling water to the steam generators during normal operation" and the reliability of the turbine control system design function "to control the amount of steam entering the main turbine during normal operation."

4.2.1.2 Screening of Changes to Procedures as Described in the UFSAR

Changes are “screened in” (i.e., require a 10 CFR 50.59 evaluation) if they adversely affect how SSC design functions are performed or controlled (including changes to UFSAR-described procedures, assumed operator actions and response times). Proposed changes that are determined to have positive or no effect on how SSC design functions are performed or controlled may be screened out.

For purposes of 10 CFR 50.59 screening, changes that fundamentally alter (replace) the existing means of performing or controlling design functions should be conservatively treated as adverse and screened in. Such changes include replacement of automatic action by manual action (or vice versa),

changes to the human-system ~~man-machine~~ interface, changing a valve from "locked closed" to "administratively closed" and similar changes.

~~3.1 INTRODUCTION Similarly, a proposed activity involving a digital modification does not necessarily involve a fundamental change in how a design function is performed or controlled. The mere fact that a digital processor "calculates" a numerical value or "generates" a control signal using software is not fundamentally different from a numerical value or a control signal using analog components if the digital device (hardware and software) cannot produce erroneous numerical values or control signals due to failures any different from those produced by the analog devices. Similarly, the mere fact that a touchscreen may be used in place of hard controls (i.e., pushbuttons, knobs, switches, etc.) to operate or control plant equipment is not fundamentally different from the hard controls if the digital device (hardware and software) cannot produce erroneous operations or controls due to failures any different from those produced by the analog devices.~~

~~Examples 3-1 and 3-2 illustrate the relationship between a digital modification and the concept of a fundamental change in how a design function is performed.~~

Example 3-1. Digital Modification that does NOT contain a Fundamental Change to How a Design Function is Performed or Controlled

Flow in a system is measured using a venturi (which generates a differential pressure signal that is described in the UFSAR) and the instrumentation loop contains analog components (which are not described in detail in the UFSAR). If of the analog components (except for the venturi itself) are replaced with digital components and/or a digital control system, but flow is still developed using the differential pressure signal, there is no change in how the design function (i.e., measuring flow) is performed.

The use of digital equipment (hardware and software) still needs to be addressed the Screen to determine the impact on the pertinent design functions, but not as a "fundamental" change.

Example 3-2. Digital Modification that DOES contain a Fundamental Change to How a Design Function is Performed or Controlled

Main feedwater flow to the steam generators is manually controlled by the license Operators, who use steam generator level to determine if flow should be adjusted. There are two analog control systems, one for each MFWP, that are both physical and functionally the same. All of these features (i.e., manual operation, adjustments based on level and two separate control systems) are described in the UFSAR. Two new digital feedwater control systems will replace the analog control

Commented [BD15]: NEI 96-07r1 indicates any change to HSI fundamentally alters the means of performing or controlling a design function and should screen in. NEI 01-01 recognized that not all HSI changes are adverse and provided specific criteria to consider. The NEI 01-01 approach was maintained in this document.

Commented [BD16]: NEI 01-01 was used instead of this proposed App D wording because NEI 01-01 was clearer, more concise, and provided specific criteria for screening out HSI.

Commented [BD17]: The first paragraph of this section states "Changes are "screened in" (i.e., require a 10 CFR 50.59 evaluation) if they adversely affect how SSC design functions are performed or controlled (including changes to UFSAR-described procedures, assumed operator actions and response times)." This section involves how operators, not plant equipment, performs or controls design functions. This example focuses on equipment. NEI 96-07r1 indicates any change to HSI fundamentally alters the means of performing or controlling a design function and should screen in. NEI 01-01 recognized that not all HSI changes are adverse and provided specific criteria to consider. The NEI 01-01 approach was maintained in this document.

Commented [BD18]: NEI 96-07r1 indicates any change to HSI fundamentally alters the means of performing or controlling a design function and should screen in. NEI 01-01 recognized that not all HSI changes are adverse and provided specific criteria to consider. The NEI 01-01 approach was maintained in this document.

systems, maintaining the original separation provided by the analog systems. The new control systems will automatically control feedwater flow and will use steam generator *level* and steam generator *pressure* to determine the proper flow rate.

In this case, there are two activities that fundamentally alter how a design function is performed: (1) *manual-to-auto* and (2) *level-only to level-and-pressure*.

Note that the use of digital equipment (hardware and software) is not the source of the fundamental changes; it was the *manual-to-auto* and *level-only to level-and-pressure* activities that were the fundamental changes.

Human-system interface considerations. Changes to the human-system interface should conservatively be treated as adverse and screen in. A possible exception is if the engineering/technical information supporting the change demonstrates that human-system interface changes do not exhibit characteristics that could adversely affect the method of performing or controlling the design function which include, but are not limited to:

Commented [CN19]: This paragraph replaces the one below.

~~It is important to note that not all changes to the human-system interface fundamentally alter the means of performing or controlling design functions. Some human-system interface changes that accompany digital modifications leave the method of performing functions essentially unchanged. Technical evaluations should determine whether changes to the human-system interface create adverse effects on design functions (including adverse effects on the licensing basis and safety analyses). Characteristics of human-system interface changes that could lead to potential adverse effects may include, but are not limited to:~~

- Changes to parameters monitored, decisions made, and actions taken in the control of plant equipment and systems during transients,
- Changes that could affect the overall response time of the human/machine system (e.g., changes that increase operator burden), or
- Fundamental changes in data presentation (such as replacing an edgewise analog meter with a numeric display or a multipurpose a display screen where access to the data requires operator interactions to display), or
- Changes that create new potential failure modes in the interaction of operators with the system (e.g., new interrelationships or interdependencies of operator actions and plant response or new ways the operator assimilates plant status information).

Note, however, that these characteristics focus on potential adverse effects due to changes in the physical operator interface, not procedure changes. Changes in procedures that may be required in order to implement human-system interface changes also need to be screened.

~~3.2.2.2 PHYSICAL INTERFACE~~

~~Physical Interaction~~

~~Consideration of the digital modification on the impact on physical interaction involves an examination of the actual physical interface and how it could impact the performance and/or satisfaction of UFSAR described design functions. For example, if a new malfunction is created as a result of the physical interaction, then the HSI portion of the digital modification would be adverse. Such a new malfunction may be created by the interface requiring the human user to choose which of multiple components is to be controlled, creating the possibility of selecting the wrong component (which could not occur with an analog system that did not need the human user to make a "selection").~~

~~To determine if the HSI aspects of a digital modification have an adverse effect on UFSAR described design functions, potential impacts to the physical interaction should be addressed in the Screen.~~

~~To determine possible impacts, the UFSAR must be reviewed to identify descriptions regarding how the interaction with the current component or system is described and how that interaction contributes to UFSAR described design functions being performed and/or satisfied.~~

~~A typical physical interaction modification might involve use of a touch screen in place of push buttons, switches or knobs.~~

~~Number and/or Type of Parameters~~ ~~Potential impacts due to the modification of the number and/or type of parameters monitored should be addressed. The purpose of addressing this factor is to determine if the number of parameters and/or type of information available due to a digital modification causes an adverse impact on the performance and/or satisfaction of a UFSAR described design function. Potential causes for an adverse impact on a UFSAR described design function could include a reduction in the number of system parameters monitored (which could make the diagnosis of a problem or determination of the proper action more challenging or time-consuming to the operator), the absence of a previously available parameter (i.e., a type of parameter), a difference in how the loss or failure of parameters occurs (e.g., as the result of combining parameters), or an increase in the amount of information that is provided such that the amount of available information has a detrimental impact on the operator's ability to discern a particular plant condition or to perform a specific task. To~~

Commented [BD20]: NEI 96-07r1 indicates any change to HSI fundamentally alters the means of performing or controlling a design function and should screen in. NEI 01-01 recognized that not all HSI changes are adverse and provided specific criteria to consider. The NEI 01-01 approach was maintained in this document.

Commented [BD21]: Section 4.2.1.1 which states: However, a facility also contains many SSCs not described in the UFSAR. These can be components, subcomponents of larger components or even entire systems. Changes affecting SSCs that are not explicitly described in the UFSAR can have the potential to adversely affect SSC design functions that are described and thus may require a 10 CFR 50.59 evaluation. In such cases, the approach for determining whether a change involves a change to the facility as described in the UFSAR is to consider the larger, UFSAR-described SSC of which the SSC being modified is a part. If for the larger SSC, the change adversely affects a UFSAR-described design function, method of performing or controlling the design function, or an evaluation demonstrating that intended design functions will be accomplished, then a 10 CFR 50.59 evaluation is required.

Commented [BD22]: NEI 96-07r1 indicates any change to HSI fundamentally alters the means of performing or controlling a design function and should screen in. NEI 01-01 recognized that not all HSI changes are adverse and provided specific criteria to consider. The NEI 01-01 approach was maintained in this document..

determine possible impacts, the UFSAR must be reviewed to identify descriptions regarding which information is necessary for a UFSAR described design function to be performed and/or satisfied.

Information Presentation

Potential impacts due to the modification of how information is presented should be addressed.

The purpose of addressing this factor is to determine if the method by which information is presented due to a digital modification causes an adverse impact on the performance and/or satisfaction of a UFSAR described design function.

To determine possible impacts, the UFSAR must be reviewed to identify descriptions regarding how information is presented, organized (e.g., how the information is physically presented) or accessed, and if that presentation, organization or access relates to the performance and/or satisfaction of a UFSAR described design function.

One advantage of a digital system is the amount of information that can be monitored, stored and presented to the user. However, the possibility exists that the amount of such information may lead to an *over-abundance* that is not necessarily beneficial in all cases.

Examples of activities that have the potential to cause an adverse effect include the following activities:

- An increase in the number and/or type of parameters available for observation.
- Addition or removal of a dead band
- Replacement of instantaneous readings with time averaged readings (or vice versa).

3 2.1.1 SCOPE

The screening of proposed activities involving *procedures as described in the UFSAR* considers the Human System Interface (HSI) portion of the digital modification. The focus of the Screen is on potential adverse effects due to modifications of the *interface* between the human user and the technical device [e.g., equipment manipulations, actions taken, options available, manipulation sequences or operator response times (including the impact of errors of a cognitive nature in which the information being provided is unclear or incorrect)], not the written procedure modifications that may accompany a physical design modification.

Commented [BD23]: NEI 96-07r1 indicates any change to HSI fundamentally alters the means of performing or controlling a design function and should screen in. NEI 01-01 recognized that not all HSI changes are adverse and provided specific criteria to consider. The NEI 01-01 approach was maintained in this document.

Commented [BD24]: Incorrect. The first paragraph of this section is from NEI 96-07r1 which states that Screening covers changes to procedures.

~~With respect to creation of new potential failure modes, changes to the human-system interface should be treated in a manner similar to software and digital equipment. Specifically, a disciplined development process in which human factors issues are considered by qualified personnel and evaluated using human factors verification and validation techniques should be credited for minimizing the likelihood of human errors and inadvertently introducing a new behavior or problem that did not previously exist for the old device. NUREG-0800, Standard Review Plan, Chapter 18 Section 5.3.4.2 provides guidance on human factors considerations for design and failure analysis.~~

Example 1

The licensee is planning to replace an analog control system with a digital control system introduces additional automation that alters the required operator response to a transient (for example, a valve automatically shuts as opposed to being shut by operator action). This is considered a fundamental change in the "method of performing or controlling" the design function and a 10 CFR 50.59 evaluation is required.

Example 2

* ~~On the other hand, replacement of~~The licensee is planning to replace a strip chart recorder with a digital, paperless recorder in which ~~might screen out so long as~~ the data presentation is similar, the recorder location is unchanged, the data displayed is at least as legible as the strip chart recorder was, and the operator uses the recorder in the same way to perform the design function. The engineering/technical information supporting the change demonstrated that human-system interface changes do not exhibit characteristics that could adversely affect the method of performing or controlling the design function such as: changes to parameters monitored, decisions made, and actions taken in the control of plant equipment and systems during transients; changes that could affect the overall response time of the human/machine system; or fundamental changes in data presentation; or, changes that create new potential failure modes in the interaction of operators with the system. Therefore, the digital modification ~~there is no fundamental change in the method of performing or controlling the design function~~screens out.

~~Example 3~~

~~Component controls for a redundant safety related system are to be replaced with programmable logic controllers. The existing human-system interface for these components is made up of redundant hard-wired switches, indicator lights, and analog meters. The new system consolidates the information and~~

~~controls on two flat panel displays (one per redundant train), each with a touch screen providing "soft" control capability.~~

~~The flat panel can present any of several selectable display pages depending on what the operator is doing (e.g., starting/initiating the system, monitoring the system during operation, or changing the system line up). To operate a control, the operator must (via the touch screen) select the appropriate display page, select the component to be controlled, select the control action (e.g., start or stop), and execute it.~~

~~The new human system interface will provide better support of operator tasks and reduced risk of errors due to:~~

- ~~Consolidation of needed information into a single display that provides a much more effective view of the system operation when it is called into action.~~
- ~~Elimination of the need for an operator to seek out meter readings or indications, saving time and helping to prevent errors.~~
- ~~Integration of cautions and warning with the display to help detect and prevent potential errors in operation (e.g., warnings about incorrect system lineup during a test).~~

~~However, potential adverse effects include:~~

- ~~Increase time required to perform some control actions due to the need to call up the appropriate display and operate the "soft" control.~~
- ~~Fundamental change in the way information is presented to the operator, and different means of interacting with the controls and indications.~~

~~The design was developed using a human factors engineering design, with a verification and validation process consistent with current industry and regulatory standards and guidelines. The goal of the design is to provide a more effective human system interface that is less prone to human error than the existing design. However, because of the possible adverse effects noted above, the change is conservatively screened in and will undergo a 10 CFR 50.59 evaluation.~~

Example 3-10. Physical Interaction with an ADVERSE IMPACT on a UFSAR-Described Design Function

Using the same proposed activity described in Example 3-9, this example illustrat
how a variation in the UFSAR description would cause an adverse impact.

Commented [BD25]: Example is unclear in that it only addresses physical interaction which is only one HSI and it involves a physical interaction explicitly described in the UFSAR incorrectly implying only that only explicitly-described HSI issues can be considered adverse. Clear example is provided instead.

In this case, the UFSAR states not only that the operator can "increase and decrease the control functions using manual controls located in the Main Control Room," but also that "the control mechanism provides tactile feedback to the operator as the mechanism is rotated through each setting increment."

Since a touch screen cannot provide (or duplicate) the "tactile feedback" of a mechanical device, replacing the "knob" with a "touch screen" is adverse since it adversely impacts the ability of the operator to obtain tactile feedback from the device.

Example 3-11. Physical Interaction with an ADVERSE IMPACT on a UFSAR-Described Design Function

Using the same proposed activity described in Example 3-9 and the same UFSAR descriptions from Example 3-10, this example illustrates how a variation in the proposed activity would also cause an adverse impact.

In addition to the touch screen control "arrows" themselves, a sound feature and components are added to the digital design that emit a clearly audible and distinct "tone" each time the control setting passes through the same setting increment that the tactile feature provided with the mechanical device.

Although the operator will now receive "feedback" during the operation of the digital device, the fundamental means by which this feedback is provided has been altered. Since the fundamental means of controlling the design function has changed, new malfunctions can be postulated (e.g., high ambient sound levels that prevent the operator from hearing the feedback). Therefore, the modification of the feedback feature (i.e., from tactile to auditory) has an adverse impact on how the design function is performed.

Commented [BD26]: NEI 96-07r1 indicates any change to HSI fundamentally alters the means of performing or controlling a design function and should screen in. NEI 01-01 recognized that not all HSI changes are adverse and provided specific criteria to consider. The NEI 01-01 approach was maintained in this document.

Example 3-12. Number and Type of Parameters with NO ADVERSE IMPAC on a UFSAR-Described Design Function

A UFSAR states that the operator will "examine pump response and utilize redundant plant channels to verify performance." This statement means that parameters *directly* associated with the pump (e.g., motor electrical current, discharge pressure and flow rate) and parameters *indirectly* associated with pump performance (e.g., response of redundant temperature indications or response of redundant level indications, as appropriate) are necessary to validate correct pump operation.

A new digital system presents the same number ("three") and type ("motor electrical current, discharge pressure and flow rate") of parameters. Furthermore, the new digital system presents the same indirect redundant information to the operator

Commented [CN27]: NEI 96-07r1 indicates any change to HSI fundamentally alters the means of performing or controlling a design function and should screen in. NEI 01-01 recognized that not all HSI changes are adverse and provided specific criteria to consider. The NEI 01-01 approach was maintained in this document.

Therefore, there is no adverse impact on the UFSAR-described ability to perform *direct* monitoring of pump performance and no adverse impact on the UFSAR-described ability to perform *indirect* monitoring of pump performance.

Example 3-13. Information and Data Presentation with an ADVERSE IMPACT on a UFSAR-Described Design Function

Using the pump example introduced in Example 3-12, the UFSAR describes a presentation method as consisting of "indicators with a 10 gpm increment" and the physical layout as being "by flow path" (i.e., not by channel/train).

A digital modification consolidates the information and controls on two flat panel displays (one for each redundant channel/train), each with a touch screen providing "soft" control capability. Also, due to the increased precision of the digital equipment, the increment of presentation will be improved to 1 gpm.

Two specific considerations due to the modification in data presentation include:

- A fundamental change in how the information is presented to the operator (by *channel/train* instead of by *flow path*).
- An increase in the precision of the information being provided (e.g., from the original "10 gpm increments" to "1 gpm increments").

Since the UFSAR describes a design function related to the *flow-path* approach, this portion of the proposed activity is adverse (i.e., the difference in presentation approach is fundamentally different than that described in the UFSAR). However, the increase in the display increment is not adverse since the operator will continue to be able to distinguish the minimum increment of 10 gpm as described in the UFSAR.

Commented [CN28]: NEI 96-07r1 indicates any change to HSI fundamentally alters the means of performing or controlling a design function and should screen in. NEI 01-01 recognized that not all HSI changes are adverse and provided specific criteria to consider. The NEI 01-01 approach was maintained in this document.

4.2.1.3 Screening Changes to UFSAR Methods of Evaluation

As discussed in Section 3.6, methods of evaluation included in the UFSAR to demonstrate that intended SSC design functions will be accomplished are considered part of the "facility as described in the UFSAR." The focus of this guidance is changes to the facility described in the UFSAR involving digital I&C and do not involve the use of new or revised methods of evaluation (as defined in Section 3.10).

4.2.2 Is the Activity a Test or Experiment Not Described in the UFSAR?

As discussed in Section 3.14, tests or experiments not described in the UFSAR are activities where an SSC is utilized or controlled in a manner that

is outside the reference bounds of the design for that SSC or inconsistent with analyses or description in the UFSAR. The focus of this guidance is changes to the facility described in the UFSAR involving digital I&C and do not involve tests or experiments not described in the UFSAR.

4.2.3 Screening Documentation

10 CFR 50.59 record-keeping requirements apply to 10 CFR 50.59 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 10 CFR 50.59 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 effect 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 10 CFR 50.59, and thus is not subject to 10 CFR 50.59 documentation and reporting requirements. Screening records need not be retained for activities for which a 10 CFR 50.59 evaluation was performed or for activities that were never implemented.