OFFICE OF THE INSPECTOR GENERAL

U.S. NUCLEAR REGULATORY COMMISSION

NRC Oversight of Licensee's Use of 10 CFR 50.59 Process To Replace SONGS' Steam Generators

Case No. 13-006

EVENT INQUIRY

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

OFFICE OF THE
INSPECTOR GENERAL

October 2, 2014

MEMORANDUM TO: Chairman Macfarlane

FROM: Hubert T. Bell
Inspector General

SUBJECT: NRC OVERSIGHT OF LICENSEE'S USE OF 10 CFR 50.59 PROCESS TO REPLACE SONGS' STEAM GENERATORS (OIG CASE NO. 13-006)

This accompanies the results of an Office of the Inspector General (OIG), U.S. Nuclear Regulatory Commission (NRC), event inquiry into concerns pertaining to NRC's oversight of Southern California Edison's application of the 10 CFR 50.59 process for the steam generator replacements in San Onofre Nuclear Generating Station (SONGS) Units 2 and 3. In addition, public interest groups and Congress specifically questioned SONGS' use of the 10 CFR 50.59 rule to replace the steam generators without first obtaining NRC prior approval through a license amendment. Therefore, OIG also sought to ascertain from NRC officials whether SONGS required a license amendment for the steam generator replacements and whether the problems at SONGS could have been identified through NRC's license amendment review process.

We have also provided this event inquiry report to the appropriate Majority and Ranking Members of Congress with oversight responsibilities for the NRC.

If you have any questions, please contact me, at 301-415-5930, or Joseph A. McMillan, Assistant Inspector General for Investigations, at 301-415-5929.

Attachment: As stated

cc: Commissioner Svinicki
Commissioner Ostendorff

Office of the Inspector General

EVENT INQUIRY

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SUMMARY

Basis and Scope

The Office of the Inspector General (OIG), U.S. Nuclear Regulatory Commission (NRC), initiated this event inquiry in response to concerns pertaining to NRC's oversight of replacement steam generators installed at San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 in 2010 and 2011, respectively. Southern California Edison (SCE), the license holder for SONGS, replaced the steam generators subsequent to its application of the regulatory process described in 10 Code of Federal Regulations (CFR) 50.59, "Changes, Tests and Experiments." 10 CFR 50.59 establishes the conditions under which licensees may make changes to their facility or procedures and conduct tests or experiments without prior NRC approval (i.e., without an amendment to their NRC license).

In January 2012, approximately 1 year after SONGS replaced its Unit 3 steam generators, control room operators identified a leak in one of Unit 3's two steam generators, and the plant was shut down in accordance with plant procedures. Initial inspection confirmed one small leak in one tube in one of the two steam generators. Continuing inspections of all of the steam generator tubes in both Unit 3 steam generators discovered unexpected wear, including tubes rubbing against each other as well as against retainer bars. At the time the Unit 3 leak was identified, Unit 2 was shut down for a routine refueling outage. Subsequent inspections of all Unit 2 steam generator tubes also discovered unexpected wear.

Over the next approximate year and a half, SCE pursued evaluation of Unit 3 and restart of Unit 2; however, on June 7, 2013, SCE announced its decision to permanently cease operations of SONGS Units 2 and 3. SCE's June 12, 2013, letter to NRC conveying this decision did not provide the reason for the permanent shutdown.

OIG's event inquiry examined NRC's oversight of SCE's application of the 10 CFR 50.59 process for the replacement steam generators in SONGS Units 2 and 3. OIG also sought to ascertain from NRC officials whether SONGS required a license amendment for the steam generator replacements and whether the problems at SONGS could have been identified through NRC's license amendment review process.

Background

Nuclear power reactors are licensed based on a given set of requirements, depending primarily on the type of plant. This set of requirements is called the plant's "licensing basis." A principal licensing basis document is the plant's final safety analysis report (FSAR). The FSAR and the plant's NRC license and associated technical specifications are the principal regulatory documents describing how the plant is designed, constructed, and operated. The FSAR is also a key reference document used by NRC inspectors during both plant construction and operation, and it must be sufficiently

detailed to permit the staff to determine whether the plant can be built and operated without undue risk to public health and safety.

Because a plant's design and operation are not static, certain changes are necessary over the course of a facility's operating life. Reactor licensees must follow NRC regulations to justify and implement changes in the design basis and licensing basis for their facilities, and they are required to document such changes in the FSAR. 10 CFR 50.71(e) requires the FSAR to be periodically updated. The objectives of 10 CFR 50.71(e) are to ensure that licensees maintain the information in the updated FSAR (UFSAR) to reflect the current status of the facility and address new issues as they arise so that the UFSAR can be used as a reference document in safety analysis.

NRC has defined the changes that a licensee may make to a licensed facility without prior NRC approval. Pursuant to 10 CFR 50.59 (c)(1), the holder of a license may, without obtaining a license amendment, (1) make changes in the facility as described in the FSAR (as updated), or (2) make changes in the procedures as described in the FSAR (as updated), and conduct tests or experiments not described in the FSAR (as updated) as long as a change to the technical specifications incorporated in the license is not required, and the change, test, or experiment does not meet any of the eight 10 CFR 50.59 (c)(2) criteria. If any of the criteria in 10 CFR 50.59 are not met (i.e., the change involves modification to the technical specifications or involves one of the eight criteria), the license holder must apply to NRC for a license amendment and obtain NRC's approval before implementing the change. NRC staff document their safety analysis of a license amendment request in a safety evaluation providing the technical, safety, and legal basis for NRC's disposition of the license amendment request.

Licensee Implementation of 10 CFR 50.59 Process

The Nuclear Energy Institute's (NEI) November 2000 *Guidelines for 10 CFR 50.59 Implementation* (NEI 96-07)[1] identifies the three following steps in the 10 CFR 50.59 process:

- **Applicability and Screening.** Determine if a 10 CFR 50.59 evaluation is required. First licensee determines if an evaluation is applicable to the proposed activity and, if so, performs screening to determine if the activity should be evaluated against the 10 CFR 50.59 evaluation criteria.

- **Evaluation.** If it is determined that a given activity requires a 10 CFR 50.59 evaluation, the licensee applies the eight 10 CFR 50.59 evaluation criteria (10 CFR 50.59(c)(2) (i-viii)) to determine if a license amendment must be obtained from NRC. This is a written evaluation.

[1] In its November 2000 Regulatory Guide 1.187, *Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments*, NRC states that NEI 96-07 provides methods that are acceptable to the NRC staff for complying with the provisions of 10 CFR 50.59.

- **Documentation and Reporting.** Document and report to NRC the activities implemented under 10 CFR 50.59. Records maintained must include a written evaluation that provides the basis for the determination that the change, test, or experiment does not require a license amendment.

Frequency of Use

Nuclear reactor licensees have used the 10 CFR 50.59 process thousands of times to make changes without NRC preapproval. Licensees conduct about 475 10 CFR 50.59 screenings per unit per year, and about five 10 CFR 50.59 evaluations per unit per year for a nationwide total of about 49,000 screenings and evaluations per year.

Since 1989, 53 of the 65 plants that utilize steam generators have replaced their steam generators under 10 CFR 50.59, while 6 replacements were made subsequent to a license amendment.

NRC Oversight of Licensees and Their Application of the 10 CFR 50.59 Process

NRC inspects licensees' application of the 10 CFR 50.59 process through an NRC Reactor Oversight Process (ROP) baseline inspection procedure (IP), IP 71111.17, "Evaluations of Changes, Tests, or Experiments and Permanent Plant Modifications." This triennial inspection is intended to provide assurance that required license amendments have been obtained.

Findings

Issue 1. Missed Opportunities During NRC Region IV 2009 Inspection

OIG found that NRC missed an opportunity during a 2009 triennial baseline inspection of SONGS' implementation of the 10 CFR 50.59 process to identify weaknesses in the SONGS steam generator 50.59 screening and evaluation package. While a Region IV inspection team selected the SONGS Unit 2 steam generator 10 CFR 50.59 screening and evaluation package as one of 35 items sampled during a 2009 triennial baseline ROP inspection at SONGS, the inspection team did not identify various shortcomings noted more recently by NRC subject matter experts who reviewed the steam generator screening and evaluation package subsequent to SONGS' shutdown due to problems with steam generator design.

The 2009 inspection team concluded from its review of the 35 items sampled that SONGS had correctly determined that the changes SONGS made could be made without a license amendment. However, the NRC subject matter experts who reviewed the Unit 2 steam generator screening and evaluation package following SONGS' shutdown identified questions pertaining to the Unit 2 steam generator 10 CFR 50.59 screening and evaluation, some of which NRC says cannot now be answered based on available information. The questions raised by the subject matter experts pertain to (1) insufficient support for 10 CFR 50.59 evaluation conclusions that contributed to the

decision that a license amendment was not needed and (2) methodology changes that should have been considered for screening but were not listed in the screening documentation. OIG found that (1) without knowing whether everything that should have been screened was screened, and the outcomes of these screenings, and (2) without reviewing additional information concerning the evaluation conclusions, there is no assurance that NRC reached the correct conclusion in its 2009 inspection that SONGS did not need a license amendment for its steam generator replacement.

OIG found that the primary inspector who reviewed the SONGS Unit 2 steam generator 10 CFR 50.59 screening and evaluation package during the 2009 baseline inspection (at approximately the same time installation of the Unit 2 steam generators commenced) described conducting a review that aligned with inspection guidance, but said that in hindsight, with the experience he now has, he might have probed further into certain aspects of the screening and evaluation package. This inspector, and others interviewed during the investigation, identified a need for improvement in training and guidance to inspectors for the 50.59 inspection. Although several senior managers acknowledged some of the shortcomings in the SONGS screening and evaluation package, they supported NRC's inspection approach, which relies on sampling and judgments made by inspectors with different backgrounds and experience levels. One senior manager expressed confidence in the 50.59 inspection process, and noted that the purpose of NRC's 50.59 inspection is not to identify design flaws, but rather to determine whether licensees are correctly implementing the 50.59 rule and reaching the correct conclusions as to the need for NRC preapproval. At the same time, senior managers, subject matter experts, and inspectors expressed general agreement that NRC needs to improve its 10 CFR 50.59 inspection training and guidance.

Issue 2. AIT Review of SCE's 10 CFR 50.59 Evaluation

OIG found that although an NRC Region IV[2] Augmented Inspection Team (AIT), established to assess the circumstances surrounding the tube leak and unexpected wear of tubes in the Unit 3 steam generators, included a review of the SONGS 50.59 steam generator package to determine whether SONGS needed a license amendment prior to installing the new steam generators, the AIT did not document an answer to this question. In its initial July 18, 2012, inspection report, the AIT communicated that the Office of Nuclear Reactor Regulation (NRR) Project Manager assigned to perform the review identified one unresolved item (URI number 10, "Change of methodologies associated with 10 CFR 50.59 review") for which additional information was needed to determine if performance deficiencies exist or if the issues constituted violations of NRC requirements. The URI described two instances that failed to adequately address whether the change involved a departure of the method of evaluation described in the UFSAR. Although NRC's November 9, 2012, AIT followup report documented the

[2]NRC's Region IV regional office in Arlington, Texas, oversees NRC regulatory activities in the western and southern mid-western United States.

closure of this URI, and stated that neither change would have required a license amendment, it did not answer the overall question of whether a license amendment was required.

The AIT Team Leader and the current Region IV Deputy Regional Administrator told OIG that based on what NRC reviewed during its inspections, the conclusion was that a license amendment was not needed, although each allowed that the sampling approach used to perform this assessment could have missed something. The Acting NRR Director said he could not determine if an amendment was needed or not due to the gaps that may exist regarding items that may require screening and/or evaluation. The current Region IV Deputy Regional Administrator said additional inspection would be required to answer whether a license amendment was required, and questioned whether it would be a prudent use of resources to go back and accomplish that. The former Region IV Deputy Regional Administrator said that in hindsight, he believes that SONGS should have requested a license amendment from NRC prior to making the change. He also believes the steam generator design was fundamentally flawed and would not have been approved as designed. He said the AIT discussed a potential 50.59 criteria violation because of the design issues; however, the AIT ultimately identified a design control violation.

OIG found that NRC's justification for closing out URI number 10 does not align with specific language in 10 CFR 50.59 concerning NRC approval for a change in methodology, but was based instead on Region IV's interpretation (in consultation with NRR) of the rule. 10 CFR 50.59 (a)(2)(ii) reflects that changes from a method described in the UFSAR to another method are permissible without NRC preapproval if that method has already been approved by the NRC for the "intended" application. In closing out the URI, however, the AIT followup report determined the change of methods would not have required a license amendment based on NRC's approval for the use of the method at other nuclear power plants in "similar" applications. OIG notes that while the AIT characterized the issue as a change in methodology, it justified closing the matter based on approval for a "similar" application rather than the "intended" application as stated by the rule.

OIG also notes that while the AIT inspection report identified an unresolved issue pertaining to the SONGS 10 CFR 50.59 screen and evaluation package, the NRR technical specialist who reviewed the package used a sampling approach and did not identify many of the shortcomings described under issue 1 of this report.

Issue 3. NRC Oversight of SONGS UFSAR

OIG found that NRC does not consistently use one of its primary oversight methods to assess whether licensees are keeping their power plant licensing basis documentation up to date as required by 10 CFR 50.71(e). Although licensees are required, per 10 CFR 50.71(e), to biannually submit UFSAR updates reflecting the current status of the facility so that the document can be used as a reference document in safety analysis, the NRR project managers tasked to review these submittals do not always conduct the

reviews within the required 90-day timeframe. Moreover, although licensees also must biannually submit, per 10 CFR 50.59(d)(2), information concerning changes made under 10 CFR 50.59 without NRC prior approval, NRR project managers – who are instructed to consider this information during their review of 10 CFR 50.71(e) submittals – do not always take the 10 CFR 50.59(d)(2) information into consideration during their reviews. OIG found that while NRC expects a plant's UFSAR to accurately reflect a plant's licensing basis, the former Region IV Deputy Regional Administrator said that during the SONGS AIT, Region IV staff noted the licensee had made many changes to the steam generators over a 25-year period that were not reflected in the UFSAR or consistent with the original Safety Analysis Report (SAR.)

OIG reviewed documentation of project manager reviews in two NRR branches and found project managers reviewed only 5 of the 21 most recently received licensee UFSAR submittals within the 90-day timeframe, while 7 were reviewed between 90 days and a year after receipt, and 9 reports more than a year after receipt. Moreover, only two of the project manager reviews contained a reference to review of 10 CFR 50.59 documentation submitted by licensees even though project manager guidance directs that this occurs. OIG also found that over a 10-year period, NRC staff documented two reviews of changes to SONGS' UFSAR, although the licensee submitted six UFSAR updates during this period as required, and neither NRC review mentioned consideration of 10 CFR 50.59 changes.

Although senior NRC managers expect the project managers to conduct the reviews within the required timeframe, and to consider changes made under 10 CFR 50.59 as part of that review, two NRR project managers interviewed said the reviews are considered a low priority. Neither of the project managers included the 10 CFR 50.59 information in their reviews of 50.71(e) submittals; one thought this review was conducted by a different NRR group and the other thought the 10 CFR 50.59 information was used by regional inspectors for a different purpose.

In contrast, the Deputy Executive Director for Reactor Preparedness Programs considers NRC's oversight of 10 CFR 50.71(e) to be critical for enabling NRC to know whether a plant is in compliance with its licensing basis, and considers the project manager review of 50.71(e) submittals to be a priority. While the former NRR Director also expected project managers to conduct the required reviews to assess whether changes made by the licensees have generally been updated into the FSAR, he viewed the project manager's review as a bookkeeping exercise that is based on the experience of the project manager. He noted that the FSAR review is a self-imposed requirement and if NRC is not meeting its own internal guidance, then it should either meet the requirement or change the guidance based on safety significance.

I. BASIS AND SCOPE

The Office of the Inspector General (OIG), U.S. Nuclear Regulatory Commission (NRC), initiated this event inquiry in response to concerns pertaining to NRC's oversight of replacement steam generators installed at San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 in 2010 and 2011, respectively. Southern California Edison (SCE), the license holder for SONGS, replaced the steam generators subsequent to its application of the regulatory process described in 10 Code of Federal Regulations (CFR) 50.59, "Changes, Tests and Experiments." 10 CFR 50.59 establishes the conditions under which licensees may make changes to their facility or procedures and conduct tests or experiments without prior NRC approval (i.e., without an amendment to their NRC license).

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OIG's event inquiry examined NRC's oversight of SCE's application of the 10 CFR 50.59 process for the replacement steam generators in SONGS Units 2 and 3. In addition, public interest groups and Congress specifically questioned SONGS' use of the 10 CFR 50.59 rule to replace the steam generators without first obtaining NRC prior approval through a license amendment. Therefore, OIG also sought to ascertain from NRC officials whether SONGS required a license amendment for the steam generator replacements and whether the problems at SONGS could have been identified through NRC's license amendment review process.

A total of 30 NRC employees and 4 SCE employees (including one former employee) were interviewed for this event inquiry.

II. BACKGROUND AND CHRONOLOGY

Plant Licensing Basis and 10 CFR 50.59 Change Process

Nuclear power reactors are licensed based on a given set of requirements, depending primarily on the type of plant. This set of requirements is called the plant's "licensing basis," defined in 10 CFR 54.3 as "the set of NRC requirements applicable to a specific plant and a licensee's written commitments for ensuring compliance with and operation within applicable NRC requirements and the plant-specific design basis (including all modifications and additions to such commitments over the life of the license) that are docketed and in effect."

A principal licensing basis document is the plant's final safety analysis report (FSAR).[3] The FSAR and the plant's NRC license and associated technical specifications are the principal regulatory documents describing how the plant is designed, constructed, and operated. The FSAR is also a key reference document used by NRC inspectors during both plant construction and operation, and it must be sufficiently detailed to permit the staff to determine whether the plant can be built and operated without undue risk to public health and safety.

Because a plant's design and operation are not static, certain changes are necessary over the course of a facility's operating life. Reactor licensees must follow NRC regulations to justify and implement changes in the design basis[4] and licensing basis for their facilities, and they are required to document such changes in the FSAR. 10 CFR 50.71(e) requires the FSAR to be periodically updated. The objectives of 10 CFR 50.71(e) are to ensure that licensees maintain the information in the updated FSAR (UFSAR) to reflect the current status of the facility and address new issues as they arise so that the UFSAR can be used as a reference document in safety analysis.

NRC has defined the changes that a licensee may make to a licensed facility without prior NRC approval. Pursuant to 10 CFR 50.59[5](c)(1), the holder of a license may, without obtaining a license amendment, (1) make changes in the facility as described in the FSAR (as updated), or (2) make changes in the procedures as described in the FSAR (as updated), and conduct tests or experiments not described in the FSAR (as updated) as long as:

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[3] The principal application document for a reactor construction permit is a preliminary safety analysis report, which is submitted at the time an operating license is sought, and is subsequently updated to become the FSAR for the facility. 10 CFR Part 50 defines, in general terms, the information that must be supplied in a safety analysis report for a nuclear power plant.

[4] Per 10 CFR 50.2, design bases means that information which identifies the specific functions to be performed by a structure, system, or component of a facility, and the specific values or ranges of values chosen for controlling parameters as reference bounds for design.

[5] 10 CFR 50.59 was promulgated in 1962, revised in 1968, and revised again in 1999. According to the October 4, 1999, *Federal Register Notice* announcing the final 1999 rule, the 1999 revision clarified the specific types of changes, tests, and experiments conducted at a licensed facility or a certificate holder that require evaluation, and revised the criteria that licensees and certificate holders must use to determine when NRC approval is needed before such changes, tests, or experiments can be implemented. The final rule also added definitions for terms that had been subject to differing interpretations and reorganized the rule language for clarity.

- A change to the technical specifications incorporated in the license is not required, and

- The change, test, or experiment does not meet any of the following 10 CFR 50.59 (c)(2) criteria:

  i. Result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the FSAR (as updated).
  ii. Result in more than a minimal increase in the likelihood of the occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the FSAR (as updated).
  iii. Result in more than a minimal increase in the consequences of an accident previously evaluated in the FSAR (as updated).
  iv. Result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the FSAR (as updated).
  v. Create a possibility for an accident of a different type than any previously evaluated in the FSAR (as updated).
  vi. Create the possibility for a malfunction of an SSC important to safety with a different result than any previously evaluated in the FSAR (as updated).
  vii. Result in a design basis limit for a fission product barrier as described in the FSAR (as updated) being exceeded or altered.
  viii. Result in a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses.

10 CFR 50.59 also stipulates that the FSAR (as updated) is expected to include FSAR changes resulting from evaluations performed pursuant to the regulation (10 CFR 50.59 (c)(3)) and directs licensees to maintain records of changes in the facility (10 CFR 50.59 (d)(1)) and to submit a report containing a brief description of any changes, tests, and experiments made under this regulation, including a summary of the evaluation of each (10 CFR 50.59 (d)(2)). This report must be submitted to NRC at intervals not to exceed 24 months.

If any of the criteria in 10 CFR 50.59 are not met (i.e., the change involves modification to the technical specifications or involves one of the eight criteria listed above), the license holder must apply to NRC for a license amendment and obtain NRC's approval before implementing the change. NRC staff document their safety analysis of a license amendment request in a safety evaluation providing the technical, safety, and legal basis for NRC's disposition of the license amendment request.

Implementation of 10 CFR 50.59 Process

The Nuclear Energy Institute's (NEI)[6] November 2000 *Guidelines for 10 CFR 50.59 Implementation* (NEI 96-07)[7] explains that 10 CFR 50.59 is the process that identifies when a license amendment is required prior to implementing changes to the facility or procedures described in the updated FSAR or tests and experiments not described in the updated FSAR, and it notes the importance of maintaining and updating the FSAR in accordance with 10 CFR 50.71(e). It states that 10 CFR 50.59 provides a threshold for regulatory review – not the final determination of safety – for proposed changes, tests, and experiments (referred to in the document as "activities").

NEI 96-07 also provides a short background on NRC's 1999 revision to 10 CFR 50.59 ("the first changes to the regulation in more than 30 years"), stating that the changes were prompted by the need to resolve differences in interpretation of the rule's requirements by the industry and the NRC that came into clear focus in 1996. The NEI document states that the 1999 changes made 10 CFR 50.59 more focused and efficient by:

1. Providing greater flexibility to licensees, primarily by allowing changes that have minimal safety impact to be made without prior NRC approval.
2. Clarifying the threshold for "screening out" changes that do not require full evaluation under 10 CFR 50.59 by adoption of key definitions.

NEI 96-07 identifies the three following steps in the 10 CFR 50.59 process:

- **Applicability and Screening.** Determine if a 10 CFR 50.59 evaluation is required. First licensee determines if an evaluation is applicable to the proposed activity and, if so, performs screening to determine if the activity should be evaluated against the 10 CFR 50.59 evaluation criteria.

- **Evaluation.** If it is determined that a given activity requires a 10 CFR 50.59 evaluation, the licensee applies the eight 10 CFR 50.59 evaluation criteria (10 CFR 50.59 (c)(2)(i-viii)) to determine if a license amendment must be obtained from NRC. This is a written evaluation.

- **Documentation and Reporting.** Document and report to NRC the activities implemented under 10 CFR 50.59. Records maintained must include a written evaluation that provides the basis for the determination that the change, test, or experiment does not require a license amendment. The licensee must submit, at least every 24 months, a report with a brief description of any changes, tests,

[6] NEI, with member participation, develops policy on key legislative and regulatory issues affecting the nuclear industry and services as a unified industry voice before Congress, Executive Branch agencies, and Federal regulators, as well as international organizations and venues.
[7] In its November 2000 Regulatory Guide 1.187, *Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments*, NRC states that NEI 96-07 provides methods that are acceptable to the NRC staff for complying with the provisions of 10 CFR 50.59.

and experiments, including a summary of the evaluation of each. NEI 96-07 notes that this reporting requirement is identical to that for UFSAR updates such that licensees may provide these reports to NRC on the same schedule.

NRC reactor licensees typically develop internal procedures to apply 10 CFR 50.59, based on guidance from NEI such as NEI 96-07, and the Utilities Service Alliance's[8] USA 50.59 Resource Manual. The USA 50.59 Resource Manual's stated purpose is to provide guidance for implementing the 10 CFR 50.59 process and the document is based on, and incorporates the implementation guidance provided in NEI 96-07 (which, as noted in footnote 1, is endorsed by NRC in Regulatory Guide 1.187).

OIG learned that SONGS' internal procedure incorporates the implementation guidance provided in NEI 96-07, and references the USA 50.59 Resource Manual to implement the 10 CFR 50.59 process. As required by the site Quality Assurance program, the SONGS 50.59 procedure describes a plant Nuclear Oversight Board, which reports to plant management and is responsible for reviewing the evaluations for adequacy.

Frequency of Use

OIG learned that nuclear reactor licensees have used the 10 CFR 50.59 process thousands of times to make changes without NRC preapproval. Licensees conduct about 475 10 CFR 50.59 screenings per unit per year, and about five 10 CFR 50.59 evaluations per unit per year for a nationwide total of about 49,000 screenings and evaluations per year.

Since 1989, 53 of the 65 plants that utilize steam generators have replaced their steam generators under 10 CFR 50.59, while 6 replacements were made subsequent to a license amendment.

NRC Oversight of Licensees and Their Application of the 10 CFR 50.59 Process

Reactor Oversight Process

NRC's mission is to license and regulate the Nation's civilian use of radioactive materials to protect public health and safety, promote the common defense and security, and protect the environment. The agency does not operate the plants, but establishes requirements for the design, construction, operation, and security of commercial nuclear power plants in the United States. Since 2000, NRC has used the Reactor Oversight Process (ROP) to verify that U.S. reactors are operating in accordance with NRC rules, regulations, and license requirements. The ROP is NRC's program to inspect, measure, and assess the safety and security performance of operating commercial nuclear power plants, and to respond to any decline in their performance. The ROP's inspection component includes three major elements:

[8] Utilities Service Alliance (USA) is a not-for-profit cooperative designed to facilitate collaboration among its member utilities.

1. Baseline inspections – the minimum required at all plants.
2. Plant-specific supplemental inspections – performed at those plants with performance below established thresholds.
3. Generic safety issue, special, and infrequent inspections – performed to address specific safety significant issues.

As noted in NRC Inspection Manual Chapter 2515, "Light-Water Reactor[9,10] Inspection Program – Operations Phase," the NRC inspection program covers only small samples of licensee activities in any particular area. The sample sizes specified in the inspection procedures are based on the relative importance of the area covered by the procedures to the other areas inspected by the program. They are also based on the inspectors choosing a "smart" sample instead of a statistically based random sample because the risk-informed nature of the inspection program requires the inspections to be focused on those aspects of plant operations and licensee activities that could pose the greatest risk to public health and safety. Per the Inspection Manual, because the NRC does not have objective criteria for evaluating positive findings (i.e., no findings), they are not documented in baseline inspection reports.

Inspection Procedure (IP) 71111.17

NRC inspects licensees' application of the 10 CFR 50.59 process through an ROP baseline inspection, IP 71111.17, "Evaluations of Changes, Tests, or Experiments and Permanent Plant Modifications."[11] This triennial inspection monitors the effectiveness of the licensee's implementation of changes to facility SSCs, risk significant normal and emergency operating procedures, test programs, and the UFSAR in accordance with the requirements of 10 CFR 50.59. The inspection is intended to provide assurance that required license amendments have been obtained.

Chronology of SONGS Steam Generator Replacement and Failure

Located in northwest San Diego County, near San Clemente, California, and licensed to SCE, SONGS Unit 2 began commercial operation in 1983 and Unit 3 in 1984.[12] Units 2 and 3 used two steam generators per unit; the steam generators are large heat exchangers that convert heat from the reactor into steam to drive the turbine generators and produce 1,150 megawatts of electric power per unit.

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[9] The term light water reactor is used to describe reactors using ordinary water as coolant, including boiling water reactors (BWRs) and pressurized water reactors (PWRs), the most common types used in the United States.
[10] Units 2 and 3 at SONGS are light water reactors (PWRs) that use ordinary water as the coolant.
[11] IP 71111.17 (issued January 31, 2008) is the reference number for this baseline inspection procedure during the timeframe under examination by this event inquiry. In March 2013, the procedure was revised to add clarity to terminology, enhance sample selection, and guidance), renumbered, and renamed IP 71111.17T, "Evaluations of Changes, Tests, and Experiments and Permanent Plant Modifications." Unless noted otherwise, this report references language in the 2008 procedure because it was in effect at the time of the events, addressed in this report.
[12] Unit 1 went into service January 1, 1968, and was retired in 1992.

In October 2001, SONGS created a team to explore the purchase of four replacement steam generators and in February 2004, SCE filed an application with the California Public Utilities Commission for the SONGS steam generator replacement project, which was expected to cost about $680 million. While SONGS Units 2 and 3 were licensed to operate until 2022, the existing steam generators had exhibited degradation and were predicted to reach the end of their operating life within the next several years.

In September 2004, Mitsubishi Heavy Industries in Kobe, Japan, was awarded the contract to fabricate the new steam generators. In December 2005, Bechtel was awarded the installation contract, and the California Public Utilities Commission approved the steam generator replacement project.

On June 7, 2006, SCE notified NRC of its intent and timeline to replace Units 2 and 3 steam generators under 10 CFR 50.59. The SCE briefing document indicated there would be no associated power uprate and that associated technical specification[13] changes were scheduled to be identified in 2007. The briefing document identified the following key design improvements: larger surface area, alloy 690 thermally treated tubing, improved anti-vibration bar design, integral steam nozzle, improved material for tube supports, and a forged shell. The briefing document also identified that while both the original and replacement steam generators were identical in height and upper diameter (65'6" and 22', respectively), the replacement steam generator would weigh 643.6 tons, which was 23.6 tons heavier than the original and the replacement would have more tubes than the original (9,727 versus 9,350).

SCE documented its 10 CFR 50.59 screen and evaluation for the Unit 2 and 3 steam generator replacement in engineering change packages NECP 800071702 and NECP 800071703, respectively. SCE concluded that the steam generator activities could be implemented per plant procedures without obtaining a license amendment.

Installation of Unit 2 replacement steam generators began in September 2009 and was completed in April 2010. NRC Region IV inspection activity (NRC Region IV provides oversight of SONGS) included a review of selected portions of modifications for the replacement steam generators to determine if changes were in accordance with 10 CFR 50.59; no issues were identified.

Installation of Unit 3 replacement steam generators began in October 2010 and was completed in February 2011. NRC Region IV inspection activity included a review of key design aspects and modifications associated with the steam generator replacements; no issues were identified.

On January 31, 2012, SONGS Unit 3 shut down due to indications of a steam generator tube leak. Steam generator tube inspections confirmed one small leak on one tube in one of the two steam generators. Continuing inspections of all of the steam generator tubes in both Unit 3 steam generators discovered unexpected wear, including tube to

[13] Technical specifications set forth the limits, operating conditions, and other requirements imposed upon facility operation for the protection of public health and safety.

tube as well as tube to tube support structural wear. In addition, pre-planned testing of the SONGS Unit 2 steam generator tubes was in progress as part of a regularly scheduled refueling outage when the event occurred in Unit 3. Testing results from Unit 2 also revealed unexpected tube wear at the retainer bars. The integrity of steam generator tubes is important because the tubes provide an additional barrier inside the containment building to prevent release of radioactive steam.

On March 14, 2012, three tubes in Unit 3 failed a pressure test indicating they would be more likely to rupture during certain plant events that affect the pressure inside the steam generator.

On March 15, 2012, the NRC commenced an onsite Augmented Inspection Team (AIT) assessment of the SONGS Unit 3 steam generator tube degradation. AITs are used by NRC to review more significant events or issues at NRC-licensed facilities. The inspection team included inspectors from the NRC's Region IV office, Region II office, NRC headquarters in Rockville, MD, and the SONGS Resident Inspector.

On March 27, 2012, NRC Region IV issued a Confirmatory Action Letter (CAL) to SONGS, Units 2 and 3, for commitments to address steam generator tube degradation. This CAL was to remain in effect until the NRC had (1) reviewed SCE's response to the actions listed in the letter, including responses to staff's questions and the results of evaluations, and (2) the staff communicated to SCE in written correspondence that it had concluded that SONGS Units 2 and 3 could be operated without undue risk to public health and safety, and the environment. The CAL noted that during evaluations and steam generator pressure testing for Unit 3, eight tubes failed pressure testing indicating that these tubes could have failed under some accident conditions. For Unit 2, six tubes required plugging, and 186 additional tubes were plugged as a precautionary measure.

On July 18, 2012, NRC Region IV issued an NRC AIT Report 05000361/2012007 and 05000362/2012007. The team concluded that plant operators responded to the January 31, 2012, steam generator tube leak in accordance with procedures and in a manner that protected public health and safety. Plant safety systems worked as expected during the event. The NRC team identified 10 unresolved items requiring additional review for regulatory action. One of the items, "Change of methodologies associated with 10 CFR 50.59 review," pertained to the SONGS 50.59 replacement steam generator evaluation.

On October 3, 2012, SCE submitted a response to the March 27, 2012, CAL. The response included detailed information demonstrating completion of Unit 2 CAL actions. The response also included SCE's Unit 2, Return to Service Report and a list of new commitments identified.

On November 8, 2012, the Commission issued an Order to the Atomic Safety and Licensing Board Panel and the NRC staff to address portions of a June 18, 2012, petition submitted by Friends of the Earth (an environmental advocacy group). The

petition requested that NRC order SCE to submit a license amendment application for the design and installation of the SONGS Units 2 and 3 replacement steam generators and to suspend SCE's licenses until they were amended. The petition stated the licensee was required to obtain a license amendment when it replaced the original steam generators at SONGS. The Commission Order (CLI-12-20) directed the staff to examine this portion under the 10 CFR 2.206 process. 10 CFR 2.206 allows any member of the public to raise potential health and safety issues in a petition to the NRC.

On November 9, 2012, NRC Region IV issued NRC AIT Followup Report 05000361/2012010 and 05000362/2012010. The team closed 8 of the 10 unresolved items; this included the item pertaining to the 10 CFR 50.59 evaluation. Although inspectors determined that the change in method of evaluation did not require a license amendment prior to implementing the change, a minor violation[14] of 10 CFR 50.59(d)(1) was identified because the evaluation did not provide a correct basis for the licensee's determination that the change did not require a license amendment prior to implementing the change.

On June 7, 2013, SCE announced its decision to permanently shut down SONGS Units 2 and 3. Upon learning this, the NRC terminated its review of SCE's CAL Response for Unit 2, dated October 3, 2012.

On June 12, 2013, SCE submitted a Certification of Permanent Cessation of Power Operations letter to the NRC, certifying that Units 2 and 3 had permanently ceased power operations. On June 28 and July 22, 2013, SCE certified all fuel had been permanently removed from Units 3 and 2 reactors, respectively.

On September 20, 2013, NRC Region IV issued a NRC CAL Response Inspection Report 05000361/2012009 and 05000362/2012009 that closed out the remaining two unresolved issues (URI) from the AIT inspection. The report documented that one unresolved item was of very low safety significance (Green) for Unit 2, and one finding that was preliminarily determined to have low to moderate safety significance (White) for Unit 3.

On December 23, 2013, the NRC issued a Final Significance Determination of White Finding and Notice of Violation regarding NRC Inspection Reports 05000361/2012009 and 05000362/2012009. This design control finding involved the failure to verify the adequacy of the thermal-hydraulic and flow-induced vibration design of the Unit 3 replacement steam generators, which resulted in significant and unexpected steam generator tube wear and loss of tube integrity on Unit 3 Steam Generator 3EO-88 after 11 months of operation.

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[14] Violations of minor safety concern are those below Severity Level IV and Green ROP's findings.

On March 14, 2014, the NRC Office of the Executive Director for Operations (EDO) initially approved an extension to August 29, 2014, to issue a proposed decision on the Friends of the Earth, 10 CFR 2.206 petition. The extension was approved "owing to the complexity of issues raised in the petition." An additional extension was requested and approved for Feburary 27, 2015.

In a March 20, 2014, memorandum, NRC's EDO provided direction to the Region IV Regional Administrator, the Director of the Office of Nuclear Reactor Regulation (NRR), and the Director of the Office of New Reactors for staff to evaluate lessons from the SONGS steam generator tube degradation event and identify and implement appropriate actions. A charter for the lessons learned review assigned the NRR Director to oversee the review process, and to present a lessons learned report to the EDO by December 22, 2014. The charter included the 10 CFR 50.59 process among several topics to be addressed by the lessons learned review. With regard to 10 CFR 50.59, the charter included the following items to consider:

- Does the 10 CFR 50.59 rule continue to be adequate for major or complex component replacements?
- Does the agency need to provide additional 10 CFR 50.59 guidance and information to (a) licensees for large or complex component replacements, (b) inspectors for their review of 10 CFR 50.59 evaluations of large or complex component replacements, and (c) project managers for their review of 10 CFR 50.59 evaluations?

III. DETAILS

ISSUE 1: Missed Opportunities During NRC Region IV 2009 Inspection

Background

As noted in the background section of this report, NRC inspects licensees' application of the 10 CFR 50.59 process through a triennial (every 3 years) baseline inspection IP 71111.17, "Evaluations of Changes, Tests, or Experiments and Permanent Plant Modifications." Although the procedure was most recently updated in March 2013, a January 31, 2008, version of the procedure was in effect in September 2009, when a Region IV inspection team selected the SONGS unit 2 steam generator replacement 50.59 evaluation as part of a sample to assess for its triennial conduct of IP 71111.17 at SONGS.

The four-page 2008 inspection procedure directed inspectors to (a) triennially review 6 to 12 licensee evaluations required by 10 CFR 50.59 and 12 to 25 changes, tests, or experiments that were screened out by the licensee and (b) triennially review 5 to 15 permanent plant modifications. The overall resource estimate was 172 to 212 hours for the entire inspection, which "should be performed by engineering specialists knowledgeable in the affected subject areas." (NRC Inspection Manual, Chapter 2515, states that IP 71111.17 will normally be performed by regional specialists who have achieved at least basic certification in accordance with IMC 1245, "Qualification Program for the Office of Nuclear Reactor Regulation Programs." NRC's inspector qualification process does not include a formal training course in 10 CFR 50.59 inspections (i.e. IP71111.17); however, there is an individual study activity and an on-the-job activity for reactor engineer inspectors.)

OIG learned that the SONGS 50.59 Unit 2 steam generator screening and evaluation was selected for review during 2009 relative to requirement (a) above (i.e., triennially review 6 to 12 licensee evaluations required by 10 CFR 50.59 and 12 to 25 changes, tests, or experiments[15] that were screened out by the licensee). IP 71111.17 contained the following four specific inspection steps relative to this effort:

1. Verify that when changes, tests, or experiments were made, evaluations were performed in accordance with 10 CFR 50.59. Verify that the licensee has appropriately concluded that the change, test or experiment can be accomplished without obtaining a license amendment.

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[15] 10 CFR 50.59 defines change as a modification or addition to, or removal from, the facility or procedures that affects a design function, method of performing or controlling the function, or an evaluation that demonstrates that intended functions will be accomplished.

2. Verify that safety issues related to the changes, tests, or experiments have been resolved.

3. For the changes, tests, or experiments that the licensee determined that evaluations were not required, verify that the licensee's conclusions were correct and consistent with 10 CFR 50.59.

4. Verify, as appropriate, that design and license basis documentation used to support the changes, and procedures and design and license basis documentation affected by the changes, reflect the design and license basis of the facility after the change has been made.

OIG notes that with regard to "evaluations," IP 71111.17 directs inspectors to verify that "when changes, tests, or experiments *were made* [emphasis added], evaluations were performed in accordance with 10 CFR 50.59." This language suggests that inspectors will be assessing modifications that have already been implemented.

NRC's 2009 IP 71111.17 Inspection Includes Review of SONGS 50.59 Unit 2 Steam Generator Replacement Evaluation

OIG learned that from August 24, 2009, through September 4, 2009, a three-member inspection team from Region IV conducted a triennial IP 71111.17 inspection at SONGS that included the SONGS Unit 2 replacement steam generator within the inspection sample. The Region IV inspection team was composed of a team leader and two team members; the team leader and one team member had achieved full-qualification as an NRC inspector approximately 14 months prior to the SONGS inspection and the other team member was undergoing the qualification process at the time of the inspection. (Although Region IV conducted a Plant Modification Inspection IP 71111.18 of SONGS Unit 3 on December 31, 2010, and a steam generator installation inspection on May 10, 2011, neither inspection team selected the Unit 3 steam generator as part of the inspection sample.)

The Region IV team conducted the IP 71111.17 inspection at SONGS and reported its inspection results within the body of an NRC integrated inspection report dated November 5, 2009.[16] The integrated inspection report described the results of a 3-month period of inspection by resident inspectors and region-based inspectors.

Section 1R17, "Evaluations of Changes, Tests, or Experiments and Permanent Plant Modifications (71111.17)," of the integrated inspection report described the three-member team's inspection scope and findings. Section 1R17 stated that the inspectors reviewed 8 evaluations required by 10 CFR 50.59; 15 changes, tests, or experiments

[16] "San Onofre Nuclear Generating Station – NRC Integrated Inspection Report 0500361/2009004 and 05000362/2009004, and Notice of Violation," describes the results of the 3-month period (June 24 through September 23, 2009.) The report identified a cited violation of "very low safety significance" and four other findings of very low safety significance, which NRC opted to treat as noncited violations because of their low safety significance and because they were entered in the licensee's corrective action program. OIG noted that none of the violations were outcomes of the IP 71111.17 inspection.

that were screened out by the licensee; and 12 permanent plant modifications. An attachment to the inspection report listed, by number, the 15 screens, 8 evaluations, and 12 plant modifications the inspectors reviewed. Included within the list of eight evaluations reviewed was number 800071702, which OIG learned was the number SONGS assigned to its 10 CFR 50.59 screening and evaluation pertaining to its Unit 2 replacement steam generators.[17]

Section 1R17 stated:

> The inspectors verified that when changes, tests, or experiments were made, that evaluations were performed in accordance with 10 CFR 50.59 and that licensee personnel had appropriately concluded that the change, test, or experiment can be accomplished without obtaining a license amendment. The inspectors also verified that safety issues related to the changes, test, or experiments were resolved. The inspectors reviewed changes, tests, and experiments that licensee personnel determined did not require evaluations and verified that the licensee personnel's conclusions were correct and consistent with 10 CFR 50.59. The inspectors also verified that procedures, design, and licensing basis documentation used to support the changes were accurate after the changes had been made.

In addition, Section 1R17 described the work performed to inspect plant modifications and stated inspectors verified that supporting design and license basis documentation had been updated accordingly and was still consistent with the new design, and that procedures, training plans, and other design basis features had been adequately accounted for and updated. In summary, Section 1R17 stated that the activities performed "constitute completion of one sample" and that no findings of significance were identified.[18]

OIG also learned that a March 4, 2010, inspection report (San Onofre Nuclear Generating Station – Unit 2 Steam Generator Replacement Project Inspection Report 05000361/2009007) relied, in part, on section 1R17 from the November 2009 integrated inspection report, to conclude that no findings of significance were identified with regard to a portion of the inspection addressing "Design and Planning Inspections." The March 4, 2010, report documented the results of NRC's conduct of IP 50001 (Steam Generator Replacement Inspection) over a 10-month period of inspection by resident and regional inspectors. Section 50001.02 (Inspection Requirements) directs inspectors to conduct selective inspections that will (1) verify that selected design changes and modifications to SSCs described in the FSAR are reviewed in accordance with 10 CFR 50.59 using

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[17] SONGS used the following identifier: NECP 800071702, Steam Generator Replacement Unit 2, ASC D0018051, in its documentation.

[18] Appendix A to Inspection Manual Chapter 2515, "Light-Water Reactor Inspection Program – Operations Phase," states, "The purpose of reporting the results of baseline inspections is to document the scope of inspections and any substantial negative findings in support of the assessment process. . . . The NRC does not have objective criteria for evaluating positive findings. Therefore, the assessment process does not incorporate positive findings and they will not be documented in baseline inspection reports."

procedure IP 71111.17 as guidance, and (2) review key design aspects and modifications for the replacement steam generators and other modifications associated with steam generator replacement utilizing IP 71111.17 as guidance.

Review of NECP 800071702

OIG reviewed SONGS' Unit 2 Steam Generator Screening and Evaluation (identified by SONGS as NECP 8000071702) package, which states it was completed on September 18, 2009.[19] The screening portion of the document is divided into five parts:

- Section I, "General Information," which describes the proposed activity and identifies the portion of the activity covered by the screen. For example, this section identifies specific values of major design basis parameters for the replacement steam generators that were not consistent with those of the original steam generators, physical changes between the old steam generators and the new, and methods of evaluation for the steam generators as described in the updated FSAR and their respective sections in the updated FSAR.

- Section II, Screen Concerns, which provides the licensee's answers to five screening questions used to determine whether the parameter changes, physical changes, and methods of evaluation identified in Section I needed to be evaluated under 10 CFR 50.59 to determine whether NRC approval was needed prior to making the change.

- Section III, Screen Conclusion, which reflected the overall result of the screen as adverse[20] based on the responses in Section II. Section III listed three issues that would need to undergo a 10 CFR 50.59 evaluation to determine whether NRC preapproval was needed. Each of the three issues pertained to methods of evaluation.

- Section IV, References, which lists supporting documents used to conduct the screen analysis such as topical reports containing analysis details. It also lists sections of the UFSAR reviewed by the licensee as part of the screening and evaluation.

- Section V, Summary, which notes that the September 18, 2009, 10 CFR 50.59 screen operation replaced an earlier version with two corrections but that the conclusion of the original screen remains valid.

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[19] OIG learned that SONGS provided the IP 71111.17 inspection team with an earlier version of the 10 CFR 50.59 replacement steam generator screening and evaluation package prior to their August 4, 2009, initiation of the inspection. However, the September 18, 2009, revision reviewed by OIG is the official docketed version that SONGS submitted to the NRC, on February 14, 2013, in response to a request from NRC associated with SONGS' Unit 2 CAL response (see page 8 of this report for information on the CAL). The September 18, 2009, revision refers to an earlier version of the document, but states the only items that changed were two licensee controlled specifications and the overall conclusion of the original screen remains valid.

[20] NEI 96-07 describes adverse in the context of the impact on the performance of SSCs and the bases for the acceptability of their design and operation.

The evaluation portion of the document provides the licensee's description of the three methods of evaluation the licensee identified, based on the screen, that needed to be evaluated under 10 CFR 50.59. The activities identified as requiring evaluation were:

- The original steam generator stress analyses described in the UFSAR utilized the ANSYS computer program, whereas the replacement steam generator analyses used the ABAQUS computer program.

- The seismic analysis of the reactor vessel internals for the replacement steam generators was performed in accordance with the methodology described in one topical report, while the corresponding original steam generator analyses described in the UFSAR referenced a different topical report.

- The tube wall thinning evaluation for the replacement steam generators changed the methods of evaluation from those described for the original steam generators in the UFSAR as follows:

    - The original steam generator analysis used the CEFLASH computer programs for main steam line break (MSLB) mass-energy blowdown analysis; the replacement steam generator analyses used manual calculation methods using the maximum differential pressure across the tube wall during the MSLB.

    - The original steam generator loss-of-coolant-accident (LOCA) analysis contained a two-step process using the STRUDL and ANSYS computer programs to calculate displacement histories and tube stresses, respectively. The corresponding replacement steam generator analysis determined tube stresses from blowdown forces using only the ANSYS computer program.

    - The original steam generator analyses considered primary loop branch line pipe break plus design basis event (DBE) and MSLB plus DBE as separate events for determining tube stress. For the replacement steam generators, the LOCA, DBE, and MSLB events were combined into one "limiting event" and the stresses for this combined event were calculated.

The evaluation documents the licensee's answers to the eight 10 CFR 50.59 criteria (see page 3 of this report for a listing of the eight criteria) relative to the three changes to method of evaluation. The licensee answered the first seven criteria (which apply to physical changes) as "N/A" and answered "no" to criterion viii (which applies to changes in methods of evaluation), followed by an explanation for the answer.

The evaluation document concluded that based on the results of the evaluation, the steam generator replacement could be implemented without a license amendment.

OIG Observations Concerning SONGS 10 CFR 50.59 Screening and Evaluation

OIG examined the SONGS' 10 CFR 50.59 screening and evaluation in light of NEI 96-07 guidance and identified examples where information in the screening and evaluation did not appear to meet NEI 96-07 guidance pertaining to the need to document results of 10 CFR 50.59 screens and evaluations.[21]

First, OIG compared the SONGS' Unit 2 steam generator 10 CFR 50.59 screening and evaluation against the UFSAR that would have been available to the 2009 inspection team and identified at least 14 changes in methods of evaluation used to test the new design in the UFSAR that were not listed in the SONGS screening. These were listed in Section 3.9 of the SONGS UFSAR, "Mechanical Systems and Components."

Second, OIG identified input parameters[22] and methods of evaluation where additional information would be required to support the licensee's conclusions. For example, in the 50.59 screen document, there are references to UFSAR sections where revised values of the replacement steam generator major design parameters are different than the values of the corresponding operating steam generator parameters. However, the screening document does not describe if these new values are input parameters, which are classified as changes to the facility and need to be evaluated under 10 CFR 50.59 criteria i through vii, or if they are elements of a method that need to be evaluated against criteria viii.[23] Other examples are the evaluations for tube wall thinning and seismic analysis where the licensee performed new analyses but did not provide sufficient information to support their conclusion that a license amendment was not needed.

Interviews of SONGS 2009 IP 71111.17 Inspection Team Members

Team Leader

The Team Leader of the SONGS 2009 IP 71111.17 inspection, a reactor inspector in Region IV's Division of Reactor Safety (DRS), did not recall any specifics of the 2009 inspection, including whether the SONGS replacement steam generator was selected

[21] NEI 96-07 states that 10 CFR 50.59 recordkeeping requirements apply to 10 CFR 50.59 evaluations performed for activities that screened in, not to screening records for activities that screened out. However, it instructs licensees to maintain documentation of items that screen out in accordance with plant procedures and states the basis for the conclusion should be documented to a degree commensurate with the safety significance of the change. NEI 96-07 states that typically, the screening documentation is retained as part of the change package.

[22] NEI 96-07 describes input parameters as those values derived directly from the physical characteristics of SSC or processes in the plant, including flow rates, temperatures, pressures, dimensions or measurements (e.g., volume, weight, size, etc.), and system response times.

[23] NEI 96-07 distinguishes methods of evaluation from evaluation input parameters. Changes to methods of evaluation (i.e., where an input parameter is considered to be an element of the methodology) described in the UFSAR are evaluated under criterion 10 CFR 50.59(c)(2)(viii), whereas changes to input parameters described in the UFSAR are considered changes to the facility that would be evaluated under the other seven criteria of 10 CFR 50.59(c)(2), but not criterion (c)(2)(viii).

for review or whether she personally reviewed any aspects of the screen and evaluation. She recalled there were two ongoing inspections at the time pertaining to the steam generator. She did not recall any discussions with the team members about any aspects of the 2009 SONGS 10 CFR 50.59 inspection.

The Team Leader described her role as the administrative coordinator of the inspection but with some technical oversight. For example, she conducts a pre-inspection review of licensees' 50.59 screens and evaluations to determine safety significance and inform sample selection; assists team members during the inspection if questions arise; and post-inspection, works to prepare the inspection report, which is based on the "feeders" prepared by the inspectors for inclusion in the resident inspector's integrated inspection report. If an inspector found an issue during the inspection, she will question the inspector to ensure the issue was not characterized incorrectly. If the inspector has no findings, the Team Leader asks a few questions to feel comfortable that the inspector looked at everything. She did not view herself as an authority on the team, and said team members were "pretty much even."

The Team Leader thought existing 10 CFR 50.59 guidance could be improved. She said she attended a November 2011 counterpart meeting for alignment between the regions on implementation of the 50.59 inspection procedure. She recalled that each region interpreted the inspection procedures differently. Additionally, the Team Leader said there was no specific training for 50.59. She thought NRC has a good 50.59 inspection program, but it needs to be revamped to eliminate these discrepancies.

Team Member 1

OIG learned that the team member who was assigned to review the replacement steam generator evaluation as part of the 2009 50.59 inspection was a Region IV DRS Reactor Inspector, and the 2009 SONGS 50.59 inspection was approximately his second 50.59 inspection. He did not remember details about his specific observations concerning his review of the screen and evaluation, but he recalled using IP 71111.17 and NEI 96-07 as his primary guidance for the inspection. He also recalled spending about 2 to 3 days on the steam generator screen and evaluation (out of about 2 weeks spent onsite for the entire inspection) and recalled that the other two members of the inspection team also participated in reviewing the screen and evaluation. He said the team "pulled the screen, which was very large, for the 50.59 for the Unit 2 steam generators and went line by line to ensure that there was no adverse impact pertaining to installation of the new steam generators at SONGS Unit 2."

Team Member 1 remembered talking with SONGS engineers and requesting additional information about the items that screened in for evaluation because "we need to independently verify that what they wrote [in the document] is backed up by what they've got out in the field. So, we would have looked at calcs, we would have pulled engineers in to show us the paperwork behind how they came up with what they wrote" in the evaluation.

While Team Member 1 could not recall exactly what he or other team members asked the SONGS engineers relative to the change in code from ANSYS to ABAQUS, he remembered discussing a statement in the evaluation ("The results of these sample analyses demonstrated that in all cases the ANSYS and ABAQUS results varied from theoretical solutions by no more than 1 percent, and ABAQUS and ANSYS results themselves were also within 1 percent of each other") with SONGS engineers. He said while neither he nor any of the other team members was an ABAQUS or ANSYS "guru," they would have asked to see evidence that this statement was supported.

Team Member 1 recalled looking at the UFSAR for the 2009 inspection but did not recall his observations at the time. However, he said his approach would be to go through each UFSAR chapter and "Google search steam generator. Every time steam generator comes up, I'm going to read the pertinent information." He said the licensee needs to identify all sections affected by the design change and he will "balance what they found versus what I found through the entire FSAR." If he identifies a difference, he questions it with the licensee staff. He said that each team member has their area of expertise and, as a mechanical inspector, his expertise was with mechanical issues. He said he personally probably reviewed two of the items that screened in for evaluation, based on his expertise. He said he would not have been involved with any "seismic-type" questions.

Team Member 1 explained the team documented its inspection by writing a "feeder," which contains information that is incorporated into a quarterly inspection report. He said the feeder contains the number of items inspected; it does not provide details of what was examined, or how or who examined the screen or evaluation. The feeder will list the document number of the screen and evaluation in the reference section of the report.

Team Member 1 did not recall looking at section 3.9 of the UFSAR, titled "Mechanical Systems and Components," where methodology changes were listed as part of going through the steam generator screen, but that he likely had access to those pages. OIG pointed out several methodology changes included in Section 3.9 that were not included in the screening analysis, and the inspector said he would have expected those items to be in the screening. He said if he were doing the inspection now and came across UFSAR items indicating a methodology change that was not captured in the screen, he would question the licensee. He would provide the licensee with the procedure that said it had to be in the screen and question why it was not. He said, "if they didn't have a justification and it was in their updated FSAR, I'd give them a violation immediately."

Team Member 1 told OIG that training for 50.59 inspections could be improved. He went into this inspection right out of college and said it would have been helpful to have had more training, although it was his understanding that NRC is doing more mentoring now with new inspectors. He said NRC needs to insure inspectors are fully trained and versed in the 50.59 process. At the time of this inspection, regional inspectors were not involving the headquarters technical experts, like they do now. Team Member 1 also thought the 50.59 guidance available to inspectors is too vague. For example, he said

"more than a minimal increase" should be defined by a specific value in 10 CFR 50.59. (OIG notes that "more than a minimal increase" is the terminology used in several of the 10 CFR 50.59(c)(2) screening criteria.)

Furthermore, he noted that an inspector's knowledge and background influences the conclusion of an inspection. He said, "I could read it one way, [you] could read it a completely different way," and subsequently come up with a different conclusion. He added that inspector "skill sets are to determine and ask appropriate questions that could lead us to potential issues."

Team Member 2

Inspection Team Member 2 was a metallurgical and materials engineer and he was going through the inspector qualification process at the time of the inspection. Team Member 2 recalled having been involved in the Unit 2 integrated inspection; however, he did not recall his involvement with the 50.59 inspection. (The Team Leader confirmed Team Member 2 was involved with the 50.59 inspection.)

Team Branch Chief

A Region IV DRS Branch Chief told OIG that during the 2009 integrated inspection at SONGS that included the 10 CFR 50.59 review of the SONGS replacement steam generator, he was in a 3-month rotational position acting as the Branch Chief responsible for the Region IV DRS Engineering Branch that did the SONGS 71111.17 inspection. It was during this period that NRC issued its SONGS NRC Integrated Inspection Report 05000361/2009004 and 05000362/2009004 (containing the results of the 2009 10 CFR 50.59 inspection). The Branch Chief did not work with the inspectors on the scope of their work or provide any oversight of their onsite inspection activity, but he said he would have looked at the results they brought back and would have approved the "feeder" report that they prepared for inclusion in the integrated inspection report. The Branch Chief did not recall participating in a regional debriefing where the IP 71111.17 inspection team would have briefed senior regional officials on their findings, but he said this would have occurred prior to the writing of the feeder report. He also did not specifically recall approving the feeder report that the team prepared or anything about its contents.

Interviews of NRC Subject Matter Experts

OIG interviewed four NRC staff members who are knowledgeable about the 50.59 process to ascertain their perspectives regarding SONGS 10 CFR 50.59 replacement steam generator screen and evaluation; three of these staff members are recognized within NRC as subject matter experts concerning 10 CFR 50.59 and the fourth is an experienced senior reactor inspector. OIG asked two of these subject matter experts (an NRR Branch Chief and regional Branch Chief) to review the SONGS Unit 2, 10 CFR 50.59 screening and evaluation to ascertain their perspective on the adequacy of the document. OIG also interviewed the third subject matter expert (an NRR program

manager), who contributed to the AIT report, and one member of the SONGS AIT (a Senior Reactor Inspector). Each employee was questioned concerning their perspective on the 2009 10 CFR 50.59 inspection.

Both Branch Chiefs whom OIG asked input from provided a written summary of their responses, and both identified various shortcomings in SONGS' screening and evaluation and thought that an NRC 10 CFR 50.59 inspection should have identified at least some of the issues. The issues they identified collectively included the following:

- Although the purpose of any 50.59 process should be to evaluate changes to the facility as described in the FSAR, the SONGS evaluation rarely discusses the actual changes to the FSAR. You cannot tell from the evaluation what exact statements were changed.

- For a document that is supposed to evaluate adverse changes to "license and design basis" functional requirements, there is little mention of what the actual design and license basis requirements are. This displays a significant lack of understanding of the 50.59 process and requirements at the plant.

- There are a number of general statements in the screen that are never supported. Just stating these types of conclusions does not make it so; this is a large, involved screen that, after dissected, lacks substance. Examples cited regarding the comparison of the original steam generators (OSG) against the replacements include the following:

    - "These differences represent a vast improvement over the OSG materials in terms of corrosion, erosion-corrosion and wear resistance."

    - "These differences also represent functional improvements over the OSG components."

- There are items in the evaluation that need further explanation such as the following:

    - Use of ABAQUS instead of ANSYS – this is an entirely new methodology and the licensee never discusses whether ABAQUS has been approved by NRC for this application. This is rudimentary for evaluating a change to methodology.

    - Tube wall thinning analyses changing from CEFLASH, STRUDL, and ANSYS to manual calculations and ANSYS – there is no justification in the document for the conclusion that use of ANSYS is consistent with its intended application, constraints, and limitations. The change from CEFLASH to "manual calculations" is clearly a new methodology (i.e., without providing the documentation to support it meets NEI 96-07

guidance). Also, combining the tube stress analysis into one limiting event appears to be a new methodology.

- There are some instances where the licensee and their contractor appear to have deviated from NRC-approved guidance and, as a result, failed to perform 10 CFR 50.59 evaluations related to portions of the steam generator replacements. The most prevalent deviation from guidance involves areas where reanalysis was completed to demonstrate that all required safety functions and design requirements were met. NRC-approved guidance states that in these circumstances, the change is considered to be adverse and a 10 CFR 50.59 evaluation is required.

- Another area of deviation from guidance involves the licensee's understanding and use of guidance related to changes to one or more elements of evaluation and changes from one method of evaluation to another. Each discussion related to methods of evaluation is incomplete or flawed. In general, these discussions lack adequate detail to support the stated conclusions.

- Review of this document would take substantial effort by an inspector. There really are not enough hours allotted within the baseline 50.59 inspection to perform a good review. It would take a tremendous amount of time just to get the required documents to support the licensee's conclusions, if such documents exist.

One of the Branch Chiefs noted in his review that 10 CFR 50.59 is an administrative process to determine if facility changes can be implemented without prior NRC staff approval by way of the license amendment process of 10 CFR 50.90. He wrote, "Errors in executing the 10 CFR 50.59 process do not directly impugn the ultimate acceptability of the design and analysis associated with the proposed change."

The Branch Chief also told OIG that training was an area that needed improvement and that the quality of a 10 CFR 50.59 inspection is dependent on the inspector's knowledge, experience, and background. He said the guidance is complex and there is a lot of judgment that is applied in using it. The Branch Chief said the only way to provide effective oversight is to make sure the inspectors have the tools and training to effectively execute the inspection procedures. He said that currently, the only training people get on conducting 50.59 inspections is through the inspector qualification process and that it would be much better to have some kind of recurrent refresher training or lessons learned. The Branch Chief said some regions do more than others in that regard.

The Branch Chief also noted that NRC 50.59 inspections generally occur after the fact and it is the licensee's responsibility under the license to complete this process properly, using their procedures, and our inspection activity is reviewing that and aimed at holding them accountable on a sampling basis for the quality of the projects they produce and adherence to their procedures. He said while there may be an opportunity – if an

inspector reviews something while it is being worked on – to identify something that can change the course of the licensee's path, but typically the activities are already done in the field, or on their way to being done, before NRC starts looking.

The other Branch Chief told OIG that the 50.59 regulation is complex and NRC inspectors need clear guidance, specific training on the 10 CFR 50.59 inspection process, and increased hours to perform the inspections. In his opinion, the NEI 96-07 guidance is too vague, allows for too many judgment calls, and needs solidifying of definitions. From his experience, the licensee and NRC routinely get into disagreements because of interpretation of the guidance.

This Branch Chief told OIG that had he reviewed the SONGS 50.59 in 2009, he would have come to the conclusion that, without additional documents, he would have absolutely no reasonable assurance that SONGS could pass a 50.59 inspection. He would have told the licensee that their documentation was inadequate and not documented properly, and the licensee may have had time before the install to produce adequate documentation. The Branch Chief said he would have expected the 2009 inspectors to ask questions and follow up on the unsupported general statements made by the licensee in the 50.59 documents; however, he could not determine from the documentation he reviewed whether a license amendment was needed.

The Senior Reactor Inspector who was on the AIT told OIG he noticed issues with regard to changes in methodology and, therefore, suggested to the AIT team lead that someone take a second look at the 50.59 to determine how to treat the methodology changes described in the evaluation section. OIG asked this inspector, who performs 50.59 inspections, to review section 3.9 of the UFSAR and provide his opinion as to whether any of the methods of evaluation listed should have been screened based on applicable guidance for implementation of 10 CFR 50.59. The Senior Reactor Inspector concluded that at least 15 of the 41 codes listed in section 3.9 should have been screened and evaluated against the criteria in 10 CFR 50.59.

The NRR Program Manager who contributed to the AIT report was not an AIT member, but was selected for his technical expertise in 50.59s to review the licensee's 50.59 evaluation performed as part of the replacement steam generator modification for the AIT. The NRR Program Manager thought the region did its job in 2009, but he identified two issues for the AIT where SONGS 50.59 documentation included inadequate support for methodology changes. He did not know why the 2009 inspection did not catch the issue and said it is possible that the inspector raised these questions and the licensee offered an explanation that the inspector found acceptable. The NRR Program Manager also commented that inspectors can watch an activity every month – for years even – and then a different inspector will come in and find something the others never identified.

NRR Response to OIG Questions About Methodology Changes

In an August 25, 2014, memorandum to OIG, the Acting NRR Director reported that based on a review of all docketed information, including NRC inspection reports, NRC staff determined there was insufficient information to answer specific questions regarding whether certain methodology changes utilized with SONGS replacement steam generators that were not described in the SONGS 50.59 screen should have been described. The memorandum responded to OIG questions concerning whether 14 methodology changes should have been described in the screen. Specifically, NRC could not determine if computer codes used with the original steam generators were replaced by different codes; and if replaced, NRC could not determine if the codes had been benchmarked for use in the replacement steam generators. According to the memorandum, it was not unexpected that NRC did not have on hand all the information needed to answer OIG's questions "based on NRC Inspection Manual 2515, 'Light-Water Reactor Inspection Program,' which states, '[t]he NRC inspection program covers only small samples of licensee activities in any particular area,' and 'individual inspectors are expected to exercise initiative in conducting inspections, based on their expertise and experience.'"

The memorandum reported to OIG that it is plausible some of the methodology changes identified may have "screened out" and therefore would not have required an evaluation. The memorandum noted that screening documentation is not required by 10 CFR 50.59 and not subject to 10 CFR 50.59 documentation and reporting requirements.

In response to OIG questions where SONGS indicated codes and analytical calculations were used for the original steam generators, but were not used for the replacement steam generators, NRC staff reported they do not know why SCE did not mention these codes or any replacement codes in their 50.59 screening. The memorandum advised that implementation guidance in NEI 96-07, with regard to "Applicability," provides many possible reasons an activity may require information in the UFSAR to be updated that would not require documentation under 10 CFR 50.59.

Interviews of NRC Region IV Management

Former Deputy Regional Administrator

The former Region IV Deputy Regional Administrator[24] said that his expectations for 50.59 inspections are no different from any other inspection. He expects a thorough assessment (inspection) consistent with the guidance and the program requirements. He also expects that to the extent that problems are identified by the staff, a path is identified to ensure resolution, especially if it is a safety issue. Regarding the 50.59 inspection process, the fundamental question is to understand whether or not the

[24] The former Region IV Deputy Regional Administrator held this position from December 2010 to March 2013. From March 2013 until his retirement in November 2013, he was the Regional Administrator. This report refers to him as the former Deputy Regional Administrator.

licensing staff, NRR, needs to conduct a review before a change is permitted to the licensing basis of the plant. He said that samples are taken to see if the licensee comported with criteria of the regulation.

The former Deputy Regional Administrator told OIG that he was not directly involved and did not have any firsthand knowledge of the specific inspection activities planned or conducted during the 2009 Region IV integrated inspection at SONGS. While he read the inspection report, he had not discussed the 50.59 review with the inspector who conducted the review to gain an understanding of what the inspector reviewed and what direction he was given by his supervisor. He believed that in hindsight, SONGS needed a license amendment based on what was known today (2013), however, he could not speak to what was known in 2009 or 2010. The former Deputy Regional Administrator explained that the design, as built, was fundamentally flawed and would not have been approved under any conditions. The overall design was unacceptable because of the adverse thermal-hydraulic conditions and the upper tube structure support being inadequate.

Regarding inspection guidance procedures relevant to the 50.59 process, the former Deputy Regional Administrator stated that the inspection guidance appears to be focused on the updated FSAR, and provides some practical guidance. However, it does not address the issue of why a change might need to have pre-approval. The inspection guidance does not cover the details of the rule, why each of the 50.59 criteria exists, and how to interpret them.

According to the former Deputy Regional Administrator, the inspection guidance can be improved. He noted that he has heard from staff members that they are dissatisfied with NEI guidance. The challenge is that there are so many different types of components, structures, and systems and it is hard to write a procedure that captures all those different circumstances. Having a detailed inspection plan that allows one to probe into the important areas is part of inspection preparation and for an effort like the steam generator replacement, which is like inspecting a system, there would need to be more individuals involved, more resources, more time, and more preparation. He added that the steam generator replacement inspection guidance is focused on a number of activities including opening up containment, removing the old generators, placing new generators, patching the containment and verifying containment integrity. The guidance allocates 350 hours for this activity and only approximately 60 hours are devoted to design, including the 50.59 review, which is not very much time to actually delve into a complex component such as steam generators.

The former Deputy Regional Administrator said that the agency has to decide if it is important enough to inspect every one of these (steam generators) as they come along, and that inspections are funded and adequately supported. He recognized that there are only 12 more units that may change their steam generators. The program guidance needs to be reviewed and could be enhanced and the resource allocation needs to be reviewed. The former Deputy Regional Administrator added that guidance for

inspecting in-service steam generators experiencing tube degradation provides a lot of insight, but has not been updated in 18 years. Some of the guidance is out of date and some needs to be strengthened.

The former Deputy Regional Administrator said that there are not many findings that result from [steam generators or 50.59] inspections. When the staff initially started conducting steam generator replacement inspections they were a huge deal and the inspection plan was discussed at the branch, division, and regional administrator's level and there was a lot of communication with the other regions. However, in his view, over time these inspections have become routine.

Former Regional Administrator

The then-NRC Region IV Regional Administrator[25] told OIG he recalled being briefed by the Resident Inspector assigned to SONGS on the steam generator replacement project inspection, but he did not recall the aspects of preparation or reporting from the 2009 Integrated Inspection conducted by Region IV. However, he said that all inspections get briefed verbally in Region IV in a setting where supervisors or managers are present; thus, he presumed an outbrief did occur for the 2009 Integrated Inspection.

The former Regional Administrator stated inspectors are certified to inspect the evaluation packages per agency guidance. Region IV follows program office guidance on 50.59 and the inspection procedure. He expects inspectors to look at calculations and the engineering behind the design changes. Although these reviews are never 100 percent because they are done through sampling, his expectations are that the inspectors look hard and that they challenge. The former Regional Administrator wants them to be as thorough as they can be, but their time is limited. So they can never look at everything. He expects them to follow guidance and do a good job of fact-gathering, and then do good analysis and draw their inspection conclusions. This is true with all inspections, not just 50.59 inspections.

The former Regional Administrator told OIG that inspectors review the important functions of the important systems and components that are being changed and the evaluation behind the change to see if it is justifiable that it is not increasing the risk – not triggering those criteria from the 50.59 rule. He said the licensee's evaluation inputs are those design inputs, the design objectives, "and if they say the right things, it will pass 50.59. And if it's wrong, then something is going to get built and put in the plant that doesn't function correctly. And that's what happened at San Onofre." He said that knowing what they know now, "the steam generators as designed were basically unlicensable. We wouldn't approve them."

The former Regional Administrator advised 50.59 could be strengthened with explicit instruction to the inspector in preparation for their inspections. An overt effort should be placed to assemble the FSAR information on the subject of the change, compile all

[25] The former Region IV Regional Administrator served in this position from the Fall of 2007 until his retirement in March 2013.

information relating to the subject, wherever it is mentioned, to facilitate a comparison to the screens and evaluations on that subject. He stated questions can then be asked of a change: Where is the screen? Where is the evaluation? How was it done? He mentioned a limiting factor with 50.59 is that a lot of information contained in the licensing basis is not contained in the FSAR and may not be reviewed under 50.59.

The former Regional Administrator felt the NRC should consider excluding some design changes from 50.59. He said it is worth the time and effort for the NRC to do a license amendment on a major reactor coolant system component. He said a license amendment would not accomplish design validation, but it will get to a certain set of criteria and, in the case at SONGS, it would have caused reviewers to ask good questions to determine "What's behind it?" For example, he said that based on guidance in the Standard Review Plan,[26] one item that certainly would have been questioned by reviewers was the acceptance criteria of 95 percent (void fraction[27]), because no other plant in the industry is over 90 percent. Some reviewer would have said that this is an outlier and we need to understand that.

The former Regional Administrator stated to leave the review of such a large and broad component with the scope and depth of engineering of the steam generator with the inspection oversight program may be risky. The inspection program will miss things because it is not encompassing enough to review to the level of detail or scrutiny as does the Standard Review Plan.

Current Region IV Deputy Regional Administrator

When asked to interpret the differences of opinion from the 2009 inspection to the subject matter expert reviews during this inquiry, the current Region IV Deputy Regional Administrator said he did not know the amount of time taken in 2009 as compared to the AIT and AIT followup and any additional reviews. He said the different outcomes could reflect the level of experience of inspectors. Additionally, the 2009 inspectors and AIT/AIT followup team members would have had the benefit to ask for clarification from the licensee, where the subject matter experts interviewed by OIG may have not. He could not assess the adequacy or draw a conclusion about the 2009 inspection based on the comments of the subject matter experts and OIG review; he would need more information to determine if the 50.59 evaluation was accomplished incorrectly. He said, "There's no compelling reason at this point based on the questions to go do additional inspection on a plant that's been shut down and is in the decommissioning process." However, he added the fact that the AIT cited SONGS for a couple of minor violations, indicates the 2009 inspection team did not conduct a proper 50.59 evaluation.

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[26] NRC prepares Standard Review Plans to establish criteria that NRC staff responsible for the review of applications to construct and operate nuclear power plants use in evaluating whether an applicant/licensee meets the NRC's regulations.

[27] Void fraction is the calculated value (i.e., parameter) for the volume of gas in a given gas-liquid flow area. It is an important parameter used to characterize two phase flow of circulating water through the steam generator; and also, a key parameter used in computer models to predict the flow pattern transitions, heat transfer, and pressure drop.

The RIV Deputy Regional Administrator commented that if two 50.59 inspectors have the same information and come to different conclusions, we need to take a look at our guidance and make sure that it is clear and more objective. He advised based on what he knows about the SONGS issues, the agency may benefit from a different inspection approach to do some kind of screening and determine if a more detailed design-type review for major component replacement inspections is necessary. This issue is being addressed with the lessons learned review. Additionally, he believes there could be improvements in training and guidance, as evidenced by the subject matter experts having different observations in reviewing the SONGS replacement steam generator evaluation. And if experts have different views, inspectors with less experience may have more variability in their conclusions.

Interviews of NRC Headquarters Managers

The former NRR Director[28] told OIG he was not familiar with the 2009 Region IV integrated inspection pertaining to the SONGS 50.59 and he could not speak to the fact that there were no inspection findings related to the 50.59 screening and evaluation. However, he said that inspectors do not look at everything and are trained to sample. NRC does not have the resources, including time or manpower, to review everything and so inspectors sample. Inspectors are given guidance and are entrusted to use judgment about what they should or should not review. Although he was unfamiliar with the details of the AIT inspection, he was aware that the AIT identified issues pertaining to the 50.59 evaluation, one of which was a minor violation.

The former NRR Director said that the problem with the SONGS steam generators was a design issue. The 50.59 process would not have prevented the steam generators from leaking and this is not the purpose of the 50.59 process. The 50.59 process is not going to stop a licensee from buying bad equipment, or from operating a plant incorrectly. It is not NRC's job to make sure that a licensee buys good generators. The NRC's job is to protect public health and safety.

The former NRR Director told OIG that the 50.59 process is a threshold as to whether a licensee can take a particular action without NRC approval. The NRC staff recently completed a review of 50.59s that were conducted over a 12-year period, which had identified 138 findings of low safety significance. According to the former NRR Director, this information indicated that NRC was reviewing the 50.59s and that mistakes were being made; however, none of these findings were particularly safety-significant. Consequently, based on this data, he does not believe that he has a lot of problems with the generic use of 50.59 by licensees or a problem with NRC oversight of the 50.59 process.

According to the former NRR Director, if there were problems with the 50.59 process, it would have manifested itself in many more issues than just the steam generator issue. He noted that a steam generator replacement involves a major component, which requires doing a number of things that are significant with regard to a nuclear power

[28] The former NRR Director served in this position from May 2009 to June 2014.

plant, including breaking into the primary system. The former NRR Director added that NRC has not had an issue with the approximately 53 nuclear power plants that have changed their steam generators under the 10 CFR 50.59 process.

According to the former NRR Director, based on the information provided by OIG pertaining to methodology changes, it appeared that NRC may have done a bad job of reviewing the SONGS 50.59 during the 2009 inspection; however, one should be careful before concluding that this was a broader problem than SONGS. The inspection program is working and has worked very well in the past. He did not have data to conclude that NRC needs to do a larger inspection sample. What happened at SONGS was not particularly safety-significant. The plant shut down as intended in accordance with the plant's technical specification. The licensee found that there was a leakage and took the right actions to shut down the plant.

The former NRR Director said that NRC should assess what happened at SONGS and whether there are any lessons to learn. It was a good question to ask whether the NRC was doing enough of a review of the 50.59s being conducted. Nevertheless, as the NRR Director responsible for the operational safety of 100 nuclear power plants and research and test reactors, he has limited resources. He and the NRC staff need to remain focused on safety. He is not concerned about SONGS anymore because the plant would never be in operation again. What is of interest to him is that the mistake is never repeated and that what happened at SONGS is communicated to other licensees so they do not repeat the mistake.

Deputy Executive Director for Reactor and Preparedness Programs

NRC's Deputy Executive Director for Reactor and Preparedness Programs told OIG that the licensee's 50.59 review is intended to control changes in the plant. Safety of the plant is the licensee's primary responsibility, and NRC relies on licensees to implement technical specifications and the conditions of their license. A licensee may make changes in their facility without obtaining a license amendment only if they meet the eight criteria in 10 CFR 50.59. NRC makes sure the licensee is applying 50.59 correctly and coming to the agency for review prior to their implementation by implementing IP 71111.17. He said the 50.59 review (i.e., IP71111.17) is not a safety review by the NRC staff and is not intended to pick up problems with design flaws like 10 CFR 50.90 (i.e., license amendment requests) reviews; however, it could. Also, he said, "We're only going to be able to sample, and you always want to make sure that you're sampling the items with the highest likely safety significance input."

OIG discussed with the Deputy Executive Director the assessments provided by the four agency staff knowledgeable about 10 CFR 50.59; the Deputy Executive Director said he was not bothered that agency technical experts could have questions and end up disagreeing on some technical issues, although he said, "it certainly raises some questions." His main concern is that the process is not overly driven by subjectivity and judgment. He envisioned a process where a team interacts and collaboratively work through issues and concludes with a decision that everyone understands, even if they

do not necessarily totally align with it. The Deputy Executive Director said that the 50.59 process has to be repeatable and predictable by inspectors whether they have 10 or 30 years of experience. There are regulations and guidance that endorse an acceptable way to conduct 50.59 inspections.

The Deputy Executive Director commented that the high frequency with which licensees use the 50.59 process coupled with the relatively low frequency of issues identified by NRC suggests to him that training could be a factor. He believes that if we look at training in a broad sense - qualification training, on-the-job-training, and experience - we may be able to understand how training influenced inspectors' decisions made or should have been made differently. He did not know what improvements will result from the agency's ongoing lessons learned review for the SONGS steam generator failure, but said there will be some. For example, communications with external stakeholders will be an area that NRC improves and possibly areas with the 50.59 process and how it gets implemented.

The Deputy Executive Director was aware that stakeholders are concerned with who was at fault with respect to the steam generator problems; however, he said that from a safety perspective, he focused on determining the cause of the failure and making sure the NRC had the information it needed to make a decision about restart. "They screwed it up and we didn't pick it up. Turns out we didn't look at it in detail because they did a 50.59 review – didn't believe they needed to get us to look at [a license amendment request]."

Findings

OIG found that NRC missed an opportunity during a 2009 triennial baseline inspection of SONGS' implementation of the 10 CFR 50.59 process to identify weaknesses in the SONGS steam generator 50.59 screening and evaluation package. While a Region IV inspection team selected the SONGS Unit 2 steam generator 10 CFR 50.59 screening and evaluation package as one of 35 items sampled during a 2009 triennial baseline ROP inspection at SONGS, the inspection team did not identify various shortcomings noted more recently by NRC subject matter experts who reviewed the steam generator screening and evaluation package subsequent to SONGS' shutdown due to problems with steam generator design. The purpose of the triennial baseline inspection (IP 71111.17, "Evaluations of Changes, Tests, or Experiments and Permanent Plant Modifications") is to provide assurance that required license amendments have been obtained.

The 2009 inspection team concluded from its review of the 35 items sampled that SONGS had correctly determined that the changes SONGS made could be made without a license amendment. However, the NRC subject matter experts who reviewed the Unit 2 steam generator screening and evaluation package following SONGS' shutdown identified questions pertaining to the Unit 2 steam generator 10 CFR 50.59 screening and evaluation, some of which NRC says cannot now be answered based on available information. The questions raised by the subject matter experts pertain to (1)

insufficient support for 10 CFR 50.59 evaluation conclusions that contributed to the decision that a license amendment was not needed and (2) methodology changes that should have been considered for screening but were not listed in the screening documentation. OIG found that (1) without knowing whether everything that should have been screened was screened, and the outcomes of these screenings, and (2) without reviewing additional information concerning the evaluation conclusions, there is no assurance that NRC reached the correct conclusion in its 2009 inspection that SONGS did not need a license amendment for its steam generator replacement.

OIG found that the primary inspector who reviewed the SONGS Unit 2 steam generator 10 CFR 50.59 screening and evaluation package during the 2009 baseline inspection (at approximately the same time installation of the Unit 2 steam generators commenced) described conducting a review that aligned with inspection guidance, but said that in hindsight, with the experience he now has, he might have probed further into certain aspects of the screening and evaluation package. This inspector, and others interviewed during the investigation, identified a need for improvement in training and guidance to inspectors for the 50.59 inspection. Although several senior managers acknowledged some of the shortcomings in the SONGS screening and evaluation package, they supported NRC's inspection approach, which relies on sampling and judgments made by inspectors with different backgrounds and experience levels. One senior manager expressed confidence in the 50.59 inspection process, and noted that the purpose of NRC's 50.59 inspection is not to identify design flaws, but rather to determine whether licensees are correctly implementing the 50.59 rule and reaching the correct conclusions as to the need for NRC preapproval. At the same time, senior managers, subject matter experts, and inspectors expressed general agreement that NRC needs to improve its 10 CFR 50.59 inspection training and guidance.

ISSUE 2: AIT Review of SCE's 10 CFR 50.59 Evaluation

Background

In mid-March 2012, Region IV established an Augmented Inspection Team (AIT) to assess the circumstances surrounding the tube leak and unexpected wear of tubes in the Unit 3 steam generators.[29] A Region IV Division of Reactor Safety Branch Chief was assigned to lead the team, which also included a Region IV Resident Inspector, a Region II Senior Reactor Inspector, and four headquarters-based engineers (two from NRR, one from the Office of New Reactors, and one from the Office of Nuclear Regulatory Research). According to the March 16, 2012, AIT charter memorandum

[29] Management Directive 8.3, *NRC Incident Investigation Program*, states it is NRC's policy "to ensure that significant operational events involving reactor and material facilities licensed by the NRC are investigated in a timely, objective, systematic, and technically sound manner; that the factual information pertaining to each event is documented; and that the cause or causes of each event are ascertained." MD 8.3 explains that events may involve responses by an incident investigation team or less formal responses by an AIT or a special inspection team, depending on the level of response required. NRC Inspection Procedure 93800, *Augmented Inspection Team*, states the AIT is responsible for identifying generic safety concerns in a timely manner and emphasizing fact finding, i.e., fully understanding the circumstances surrounding the event and probable causes, and not an AIT's responsibility to examine the regulatory process to determine whether the process contributed to the cause or course of the event or determine whether NRC rules or requirements were violated, or recommend enforcement actions.

from the then Region IV Regional Administrator to the AIT Team Leader, the inspection was chartered to:

- Identify the circumstances surrounding the tube degradation.
- Review the licensee's actions following discovery of the conditions.
- Evaluate the licensee's review of potential causes of the unusual steam generator tube wear.
- Assess adequacy of licensee's actions to prevent recurrence.[30]

Included within the AIT's inspection scope was a specific item (number 4), identified to OIG by the AIT inspection team leader, which read as follows:

> "Collect and assess differences in steam generator design and manufacturing between Units 2 and 3. Review all design and manufacturing changes to ensure they were properly reviewed and approved in accordance with procedures."

The AIT Team Leader told OIG that although this paragraph did not state 50.59 specifically, the paragraph's intent was to review the licensee's 50.59 activities associated with components that may have contributed to the tube leak. The former Director, Division of Reactor Safety, NRC Region IV, also confirmed the 50.59 review was intended from the beginning under item 4 of the charter.

Review of AIT Inspection Reports

The AIT conducted its inspection of SONGS from March 19 to June 18, 2012, and on July 18, 2012, NRC issued San Onofre Nuclear Generating Station – NRC Augmented Inspection Team Report 05000361/2012007 and 05000362/2012007, describing the AIT's results. The AIT determined that the plant operators responded to the January 31, 2012, steam generator tube leak in a manner that protected public health and safety and all safety systems performed their functions to support the safe shutdown and cooldown of the plant, but that "the loss of steam generator tube integrity is a serious safety issue that must be resolved prior to further power operation."

With regard to AIT scope item number 4 pertaining to review of all design and manufacturing changes, the AIT concluded that no significant differences existed in the design requirements of Units 2 and 3 replacement steam generators, and that based on the UFSAR description of the original steam generators, the steam generators' major design changes were reviewed in accordance with the 10 CFR 50.59 requirements.

The AIT identified 10 "unresolved" items that warranted additional NRC followup inspection or review. Item number 10 pertains to the licensee's 10 CFR 50.59 steam generator review.

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[30] The AIT charter was revised on May 16, 2012, in part to also evaluate unexpected wear in the Unit 2 steam generators.

(1) Adequacy of the post trip/transient procedure.
(2) Evaluation and disposition of the Unit 3 loose parts monitor alarms.
(3) Design of the retainer bar.
(4) Control of original design dimensions.
(5) Evaluation of and controls for divider plate repair.
(6) Atmospheric controls of Unit 3 steam generators during shipment.
(7) No tube bundle support used during shipping.
(8) Evaluation and disposition of accelerometer readings during shipping.
(9) Adequacy of Mitsubishi's thermal-hydraulic model.
(10) Change of methodologies associated with 10 CFR 50.59 review.

Section 13 ("Office of Nuclear Reactor Regulation (NRR) Review of SONGS 50.59 Evaluation") of the overall AIT inspection report, summarizes the scope of the inspection effort that resulted in unresolved item 10, which pertains to the 10 CFR 50.59 review. Section 13 states that the "NRR technical specialist":[31]

- Reviewed all of the design changes associated with the replacement steam generators to determine whether the changes to the facility or procedures, as described in the UFSAR, had been reviewed and documented in accordance with 10 CFR 50.59 requirements.
- Reviewed the various information used by SCE to review the changes being made to the replacement steam generators, including calculations, analyses, design change documentation, procedures, the updated final safety analysis report, the technical specifications, and plant drawings.
- Determined if the design changes to the replacement steam generators were a change to the facility or procedures as described in the updated final safety analysis report or a test or experiment not described in the updated final safety analysis report.
- Verified that safety issues related to the changes were resolved.
- Compared the safety evaluations and supporting documents to the guidance and methods provided in NEI 96-07, "Guidelines for 10 CFR 50.59 Implementation," Revision 1, as endorsed by NRC Regulatory Guide 1.187, "Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments," to determine the adequacy of the 10 CFR 50.59 evaluations.

The AIT report stated that in reviewing SCE's 10 CFR 50.59 evaluation, the NRR technical specialist found two instances that failed to adequately address whether the change involved a departure of the method of evaluation described in the updated final safety analysis report:

(a) Use of ABAQUS instead of ANSYS: Updated Final Safety Analysis Report Sections 3.9.1.2.2.1.11 and 3.9.1.2.2.2.3 were revised to reflect that the SONGS Unit 2 and 3 original steam generators stress analyses for reactor

[31] OIG learned through interviews that the NRR technical specialist referred to in the AIT report was not one of the AIT members, but an NRR Project Manager who was asked to perform work pertaining to the SONGS 10 CFR 50.59 review in support of the AIT effort.

coolant system structural integrity utilized the ANSYS computer program, whereas the replacement steam generators analyses utilized the ABAQUS computer program. The SCE's 50.59 evaluation incorrectly determined that using the ABAQUS instead of ANSYS was a change to an element of the method described in the updated final safety analysis report did not constitute changing from a method described in the updated final safety analysis report to another method, and as such, did not mention whether ABAQUS has been approved by the NRC for this application.

(b) Use of ANSYS instead of STRUDL and ANSYS: Updated Final Safety Analysis Report Section 5.4.2.3.1.3 was revised to reflect that the SONGS Units 2 and 3 evaluation of tube stress under loss of coolant accident conditions for the original steam generators consisted of a two-step process utilizing the STRUDL and ANSYS computer programs to calculate displacement histories and tube stresses, respectively, while the corresponding replacement steam generators analysis determined tube stresses from blowdown forces using only the ANSYS computer program. While SCE's 50.59 evaluation correctly considered this a change from a method described in the FSAR to another method, the 50.59 evaluation did not mention whether the method has been approved by NRC for this application.

These two instances were identified as unresolved issue URI 05000362/2012007-10, "Evaluation of Departure of Method of Evaluation for 10 CFR 50.59 Processes." Section 13.0 concluded that additional review and followup would be required to review the departure of the method of evaluation used during the stress analysis calculations associated with the replacement steam generators.

On November 9, 2012, NRC issued San Onofre Nuclear Generating Station – NRC Augmented Inspection Team Follow-Up Report 05000361/2012010 and 05000362/2012010, reflecting the results of NRC's followup inspection of 9 of the 10 unresolved items identified by the AIT in its July 18, 2012, report. The AIT followup team was composed of four members: the same Team Leader, Region IV Resident Inspector, and Region II Senior Reactor Engineer who served on the initial inspection, plus a Region IV Engineer who was not on the original team.

The November 9, 2012, AIT followup report stated that NRC had closed 8 of the 10 unresolved items. Included among the eight closed items was URI 05000362/2012007-10, "Evaluation of Departure of Method of Evaluation for 10 CFR 50.59 Processes."

With regard to the use of ABAQUS instead of ANSYS to conduct a stress analysis for reactor coolant system structural integrity, the followup inspectors determined that the change of methods "would not have required a license amendment based on NRC's approval for the use of ABAQUS at other nuclear power plants in similar applications."

To reach this conclusion, the inspectors reviewed the Comanche Peak Updated Safety Analysis Report, and several other reports[32] describing uses of ABAQUS for applications similar to RCS structural integrity. However, the inspectors determined that the licensee's decision to use ABAQUS instead of ANSYS for reactor coolant system structural integrity analyses constituted changing a method of evaluation described in the SONGS updated safety analysis report and subsequently identified a minor violation of 10 CFR 50.59(d)(1), which requires the licensee to maintain records of changes in the facility for changes that do not require license amendments.

With regard to the use of ANSYS instead of STRUDL and ANSYS to evaluate tube stress, the inspectors did not identify a violation of 10 CFR 50.59. They noted that the licensee had used ANSYS to calculate tube stresses for both the original and replacement steam generators, so the licensee's use of ANSYS for this purpose did not constitute a change from the method described in the UFSAR. The inspectors noted that for the original steam generators, the licensee had analyzed a combination of events using STRUDL to calculate displacement histories for those events, which provided additional margin for analysis done by ANSYS. However, the inspection report stated that for the replacement steam generators, the licensee had analyzed for the most limiting event, and had sufficient margin, so STRUDL was not needed.

OIG Observations Concerning AIT Reports

OIG noted that while the July 18, 2012, AIT report identified a URI related to change of methodologies associated with SONGS' 10 CFR 50.59 review, it did not identify (1) the 14-plus changes in methods of evaluation used to test the new design in the updated FSAR, (2) the numerous input parameters and methods of evaluation where additional information would be required to support the licensee's conclusions, and (3) the general and unsupported statements and conclusions in the screen and evaluation that would require additional information to determine if these statements were supported and conclusions valid.[33]

In addition, OIG noted that the language NRC used in the followup AIT inspection report to explain why the use of ABAQUS instead of ANSYS (a "change of methods") would not have required a license amendment does not align with the language in 10 CFR 50.59. The AIT followup inspection report states that the determination that "the change of methods would not have required a license amendment was based on the NRC approval for the use of ABAQUS at other nuclear power plants in "**similar** applications."

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[32] These reports included ORNL/NRC/LTR-04/15, "Probabilistic Structural Mechanics Analysis of the Degraded Davis-Besse RPV Head," September 2004 (ML 042600455); D. Rudland, D.J. Shim, H. Xu, and G. Wilkowski, "Summary Report on Evaluation of Circumferential Indications in Pressurizer Nozzle Dissimilar Metal Welds at the Wolf Creek Power Plant to Nuclear Regulatory Commission Washington DC," April 2007 (ML 071560398); NUREG/CR-6854, "Fracture Analysis of Vessels – Oak Ridge FAVOR, v04.1, Computer Code: Theory and Implementation of Algorithms, Methods, and Correlations," September 2004 (ML061580369); NUREG/CR-6765, "Development of Technical Basis for Leak-Before-Break Evaluation Procedures," May 2002 (ML 021720594); NUREG/CR-6774, "Validation of Failure and Leak-Rate Correlations for Stress Corrosion Cracks in Steam Generator Tubes," May 2002 (ML 021510286).

[33] These items were described under the Issue 1 section of this report.

However, 10 CFR 50.59 (a)(2)(ii) describes that changes in methods of evaluation described in the UFSAR to another method requires that the latter method has been approved by NRC for the "**intended** application."

Interviews of AIT Participants

Former Division of Reactor Safety Director

The former Director,[34] Division of Reactor Safety (DRS), Region IV told OIG that he was responsible for deciding if an AIT was warranted and that he put the inspection team together. He stated the 50.59 review was intended from the beginning; even if the term "50.59" was not stated verbatim in the charter, 50.59 was certainly part of what Region IV expected and understood would be looked at, and further recognizing that NRC had done an inspection for that 50.59 modification (i.e., the 2009 Integrated Inspection, which included the 50.59 replacement steam generator package).

The former DRS Director also served as the technical manager for the AIT followup report. During that period, he had weekly phone calls with his counterparts in NRR for the technical issues. He remembered closing the 50.59 URI and that they had strong dialogue back and forth with headquarters. He recalled that in the end, the licensee was cited for not identifying the methodology change; however, the change performed the same analysis and was as effective as the original methodology and did not negate the entire 50.59.

AIT Team Leader

The AIT Team Leader told OIG that he tasked the AIT Senior Reactor Inspector from Region II to conduct the team's evaluation of SONGS' 10 CFR 50.59 evaluation as part of the AIT effort. He oversaw and held daily debriefs concerning the team's activities, but was not a 50.59 expert, and the 50.59 review was the responsibility of the Region II Senior Reactor Inspector who served on the AIT. The Team Leader also recalled that a headquarters specialist from NRR who was not part of the AIT was also involved in the 10 CFR 50.59 review effort. He recalled that the Region II Senior Reactor Inspector used NEI's NRC-endorsed guidance (NEI 96-07, *Guidelines for 10 CFR 50.59 Implementation*) to review the 50.59 screens and evaluations and determine whether a license amendment was needed. The Branch Chief said he thought the AIT did a "pretty thorough scrub" before "essentially" concluding that a license amendment was not required. He said the AIT did find a couple of minor violations, but said, "The AIT could have missed something too. We had a lot of stuff to look at...We didn't look at everything."

The AIT Team Leader informed OIG the AIT charter was developed to identify the circumstances surrounding the tube degradation, review the licensee's actions following the discovery of the conditions, evaluate the licensee's review of potential causes of the unusual steam generator tube wear, and assess the adequacy of licensee's actions.

[34] The former DRS Director served in this position from March 2013 to January 2014.

The AIT was focused on the tube degradation. He stated the AIT was not meant to look at all the design changes – only the design changes that could have an impact on the steam generator tube leak. Furthermore, the AIT inspection is an incident based inspection; he explained it is not a 50.59 inspection but questions arose regarding the adequacy of 50.59 and the AIT did more work to address those questions.

The AIT Team Leader explained the AIT cited SCE with a thermal hydraulic modeling design violation of (10 CFR Part 50) Criterion III, (Design Control), which resulted in Region IV issuing SCE an apparent white violation. He said, Region IV concluded that they did not believe the velocity information was available at the time (during the 50.59 process), like it is now. Had the information been available, SCE would have had to do something differently from a 50.59 perspective. He advised that, collectively, the team thought if SONGS had done a more thorough evaluation, they potentially could have identified the problem if they had checked the adequacy of some of the information that they had questions on, specifically questions regarding velocities and questions concerning design control. The Team Leader recalled this was the reason Region IV focused on design control, and that NRC headquarters was consulted and concurred.

Region II Senior Reactor Inspector

The Region II Senior Reactor Inspector on the AIT told OIG he was initially tasked by the AIT team leader to evaluate the differences between the Units 2 and 3 steam generators, and later asked to look into the 50.59 evaluation, although this was not in the original charter. The Senior Reactor Inspector said the decision to review the licensee's 50.59 evaluation arose after the AIT member from the Office of Nuclear Regulatory Research ran an independent thermal-hydraulic model of the replacement steam generators and identified some inconsistencies between his model and the licensee's model. The Senior Reactor Inspector said the AIT Team Leader subsequently instructed him to look at the 50.59 to determine what the FSAR included about modeling thermal-hydraulic conditions and if methodologies had changed.

The Region II Senior Reactor Inspector told OIG that based on his review of the FSAR, he concluded that the methodology used on the original steam generators for thermal-hydraulic modeling was not described. He said that 10 CFR 50.59 specifies that if the licensee departs from the methodology as described in the FSAR, then a license amendment is needed. However, because the FSAR did not contain what was used for the original steam generators, there was no basis to conclude a departure from methodology had occurred. He said, "if the methodology is not in the FSAR, they didn't depart from it. So legally, by 50.59, they don't meet that criteria."

In addition, the Senior Reactor Inspector said they (i.e., AIT team members) looked at other information in the FSAR pertaining to the steam generators that could have required a license amendment based on 50.59. To do this, they looked at how the FSAR described the steam generator design and its functions and compared it with the new generators to assess how the change impacted the design functions or the methods of performing and controlling the functions as described in the FSAR. He said

while they used Inspection Procedure 71111.17 as a guide for their review, they did not implement it line by line as would be done for the triennial inspection. He said the AIT's determination was – based on review of the FSAR, the engineering change package describing the new design, the 50.59 screen and evaluation, and other items – there was no indication that the licensee needed a license amendment.

Office of Nuclear Reactor Regulation Project Manager

The Office of Nuclear Reactor Regulation (NRR) headquarters specialist to whom the AIT Team Leader referred was an NRR Project Manager assigned as the 10 CFR 50.59 Program Manager since 2009. The NRR Project Manager told OIG he was asked by the AIT Team Leader to conduct an independent review of the SONGS replacement steam generator 50.59 to determine if the licensee made the correct determination with respect to the need for prior NRC review and approval. He was not told how to conduct the review and he was not an official member of the AIT. The Project Manager did not work onsite at SONGS, but the AIT provided him the 50.59 screen and evaluation to review relative to SONGS' 10 CFR 50.59 review of the replacement steam generators plus he had on-line access to the licensee's documents. He began his review on or about May 2, 2012, and provided a written response to the AIT Team Leader on June 7, 2012, documenting the results of his review for inclusion in the AIT Inspection Report.

The Project Manager said he reviewed the entire 50.59 screening, the entire 50.59 evaluation, and a "smart sampling" of associated reference documents. He did not specifically follow IP 71111.17 in reviewing the SONGS 10 CFR 50.59 documentation, but conducted his review based on his knowledge of NEI 96-07. He did not compare every single statement against its design change package to confirm the accuracy. If he had a question about a change to the facility as described in the FSAR, he would look at it. Any questions he had with respect to the design, he would review the design information that he had available to him. He said that reviewing the 50.59 entails reviewing a sampling and based on his years of experience as an inspector, he said, "you don't expect 100 percent of everything, but you review it. . . and you dig deeper into things that don't sound right." He said that all inspections are done by sampling. He described the 50.59 document as largely a stand-alone document that reiterates relevant information from the FSAR and what the design change said to ultimately determine if it reached the criteria[35] threshold for NRC review.

The Project Manager said that an unresolved issue (URI), with a couple of concern areas, came from his review and are described in the AIT report, in particular, the section "regarding methods of evaluation and a change from one computer program to another computer program." He said both of these areas, related to methods, were captured by his URI.

The Project Manager was involved in discussions and email exchanges with the AIT followup team and manager concerning the dispositioning of his URI. Regarding his first methodology concern area, in which the licensee replaced the computer code

[35] The criteria are described in 10 CFR 50.59 and page 3 of this report.

ANSYS with ABAQUS, he said this was a methodology change and the regulation is clear: If you use a new method, you have to justify it based on whether the NRC has previously approved that method for the intended application. He communicated to Region IV AIT followup team members that if ABAQUS had not been previously approved by the NRC for the specific application, a license amendment would be needed.

The Project Manager recalled this was an item the licensee objected to because they said it was a revision to an existing method, and not a new methodology, whereas he believed it was a new methodology. He was not sure what information the licensee provided to the AIT followup inspectors, or to what extent the NRC inspectors looked for where NRC had previously approved this method, but that the region closed the item out. He said he reviewed it and went with the region's judgment.

Regarding his second methodology concern, in which the licensee replaced the computer codes of STRUDL and ANSYS with just using ANSYS for calculating a safety event, the Project Manager said he closed this concern on a new technical understanding of the calculation and not based on 50.59 guidance.

The Project Manager acknowledged the methodology changes discussed in Issue I of this report (i.e., steam generator related methodology changes reflected in the UFSAR that were not mentioned in the licensee's 10 CFR 50.59 screen). He said he did not notice this during his review (he checked the UFSAR to see that changes mentioned in the evaluation were reflected, but did not do a reverse comparison to see if all the changes to the UFSAR were reflected in the 50.59), but the licensee should have included them in the description of changes. However, he said, "just because they should have included that, and therefore they did not evaluate . . . does not mean it would have resulted in the need for prior NRC approval. It just means they didn't completely document it."

The Project Manager attributed the problems at SONGS to "design flaws" and said that while the 10 CFR 50.59 process can pick up design type problems, it is not intended to. The purpose of 10 CFR 50.59 is not to identify design deficiencies but to determine whether prior NRC review and approval is required. He said design deficiencies should be picked up through licensee quality assurance programs and potentially through NRC oversight of licensees' design control process through inspection, which is accomplished through a sampling process.

AIT Followup Team Member

A Region IV Senior Project Engineer who was not on the initial AIT told OIG that he was the inspector responsible for reviewing URI 10, "Evaluation of Departure of Method of Evaluation for 10 CFR 50.59" for the AIT followup inspection and he prepared the writeup for the followup inspection report. He said he consulted primarily with the NRR Project Manager who identified the URI and the AIT Team Leader to reach a conclusion and that each concurred with the result. With regard to the closure of URI 10, the

Senior Project Engineer said that during the followup inspection, the licensee provided some examples where ABAQUS was used for similar tube stress calculations. He said that no one had performed the exact tube stress calculations that SONGS had performed, so they looked for similar examples where a finite element model was used to calculate tube stresses. He said, "We felt the similarity was the finite element model because tubes are tubes and metal is metal and . . . people had used ABAQUS in similar geometries to do similar-type calculations." He said the examples were similar enough to say that they had documentation that ABAQUS was an appropriate environment for doing those kinds of calculations.

The Senior Project Engineer said the team did not go back and find evidence where the NRC had written safety evaluation reports for each of these. He said all they needed were examples of cases where ABAQUS had been used for applications similar to reactor coolant system (RCS) structural integrity analyses. He said, "Our standard was use of ABAQUS for applications similar to RCS structural analysis, not methods that had been approved by the NRC for the intended application. The intended application is tube stress analyses."

After discussion with OIG about the 10 CFR 50.59 provision concerning the need for NRC approval for the "intended application" when changing from a method of evaluation concerning methodology changes described in the FSAR to another method (10 CFR 50.59 (1)(2)(ii)), the Senior Project Engineer said the inspection plan was "probably flawed" because they did not look for explicit approval by the NRC for the intended application.

With regard to the second area of concern within this URI, the Senior Project Engineer said that it was not a change in methodology because they went from using STRUDL and ANSYS to using just ANSYS to analyze a limiting event. However, when OIG discussed the use of a manual calculation to replace STRUDL, he said the regulatory basis for closing this area was "probably not" adequate, based on the rule.

Review of Closeout Justification by Subject Matter Experts

The two Branch Chiefs who reviewed the SONGS 10 CFR 50.59 screening package at OIG's request also reviewed the AIT closeout justification; both felt NRC should not have closed out the URI. Both stated that use of ABAQUS instead of ANSYS was a new methodology and the licensee's 50.59 documents do not discuss whether ABAQUS has been approved by the NRC for the application of RCS stress analysis. One of the Branch Chiefs told OIG that it appears the inspectors relied on the licensee's statement that the methodology that ABAQUS had been approved, but he could find no evidence to that effect in the documents that were referenced in the inspection report. The other Branch Chief told OIG that NEI 96-07 guidance states that licensees who cite approved methodology from another licensee need to document their review of the method, approved application, safety evaluation report, and related documentation and verify that applicable terms, conditions, and limitations are met and to ensure the method is applicable to their type of plant.

With regard to the second methodology for tube wall thinning analysis, one of the Branch Chiefs stated the change from CEFLASH, STRUDL, and ANSYS to manual calculations and ANSYS is clearly a new methodology. As just discussed, 10 CFR 50.59 requires that a change in methodology requires NRC approval for the intended application.

Region IV Response to OIG Questions

In an August 14, 2014, memorandum to OIG, the Region IV Regional Administrator provided the region's analysis supporting the closure of URI 10 in the AIT followup report. The memorandum described that NEI 96-07, Section 4.3.8.2, "Guidance for Changing from One Method of Evaluation to Another," communicates two paths for NRC approval. One path is where a vendor submits a topical report and NRC issues a safety evaluation report documenting generic NRC approval for the use of a specific analysis methodology by a given class of power plants. The second path consists of NRC approval of a specific analysis for a given plant via a license amendment.

The Region IV memorandum acknowledges that the AIT followup inspection report lists several documents that did not involve either of those two paths, but rather described the use of ABAQUS in research activities previously completed for NRC. However, following the list of research documents, the memorandum states that the AIT followup inspection report notes that the inspectors reviewed "the Comanche Peak Updated Safety Analysis Report, Section 3.6B.2.2.2 ("High-Energy Piping Other Than RCS Main Loop') that described using ABAQUS for piping dynamic responses resulting from a postulated pipe rupture." The memorandum notes that NRC approved the use of ABAQUS when it granted licenses to operate the Comanche Peak Steam Electric Station, Units 1 and 2, and that the use of ABAQUS is described in NUREG-0797, Supplement 17, "Safety Evaluation Report Related to the Operation of Comanche Peak Steam Electric Station, Units 1 and 2."

The memorandum states that Region IV technical staff, in consultation with NRR staff knowledgeable and experienced in 10 CFR Part 50.59 reviews and associated inspection processes, determined that the AIT followup inspection report discussion of Comanche Peak provided an acceptable example consistent with NRI 96-07, Section 4.3.8.2, where ABAQUS has been approved by NRC for the intended application.

Interview of NRC Office of the General Counsel Attorney

An NRC Staff Attorney from the Office of the General Counsel, Office of the Assistant General Counsel for Operating Reactors, told OIG that at Region IV's request, he reviewed the draft URI closeout language, not for directing the staff to close or not to close the URI, but instead for the clarity of the information: "how does this make sense, can you write this better in plain language?" The Staff Attorney said he first became involved with the replacement steam generators at SONGS in approximately May 2012 with the petition filing by Friends of the Earth.

The Staff Attorney explained he did not review the supporting examples SCE provided to RIV regarding SONGS methodology change from ANSYS and ABAQUS; as such, he could not determine if the examples cited by SCE either supported or did not support the staff's findings. However, he said that NEI guidance 96-07 provides a variety of examples of what constitutes methodology change approval by the NRC for an intended application. He recalled that NRC approval could be in the form of specific approval somewhere within a licensing document, such as a UFSAR, or approval could be of a topical report where the NRC has generically approved that topical report in a safety evaluation report. With respect to the Comanche Peak example provided by Region IV for approval of ABAQUS, he concluded the staff approved an safety evaluation report through the licensing process for Comanche Peak, and it was the staff's call to determine the relevance of the Comanche Peak approval to the application of ABAQUS at SONGS.

The Staff Attorney advised in the end, Region IV cited a recordkeeping violation and that was within the staff's legal authority to do. He related from a technical standpoint, he does not have the technical expertise and would rely that the "tech review" got it right, and from a legal standpoint Region IV could justifiably close this matter as a minor violation. Based on the fact that Region IV closed this URI, he would infer they had adequate support to do so.

Interviews of Region IV Managers

SONGS Special Project Branch Chief

A Region IV Branch Chief with oversight responsibility for SONGS since 2009 who also served as Branch Chief of the SONGS Special Project Branch told OIG, in hindsight, if NRC were to go through the 50.59 questions now, some of those screening questions would have to be answered yes and would require NRC approval. But back then [2007-2009], NRC did not know and SONGS did not know what NRC knows now [regarding the FIT-III thermal-hydraulic model], and an [NRC Office of Investigations] investigation was ongoing [as of February 2013] to determine what information was available. He advised all indicators are that SONGS was not aware of the failure of the code error (used with the FIT-III) and SONGS could not have predicted it.

Former Deputy Regional Administrator

The former Deputy Regional Administrator told OIG that the AIT reported to the Region IV Regional Administrator. The former Deputy Regional Administrator was not directly involved in the AIT report and he became involved in approximately September 2012, after the AIT held its exit conference with the licensee, but before the AIT (followup) report was issued [November 2012]. During the exit conference, Region IV learned that SONGS had identified an error in a software program pertaining to the void fraction.

According to the former Deputy Regional Administrator, SONGS' 50.59 did not meet the criteria 50.59 (2)(c)(ii) because design changes resulted "in more than a minimal

increase in the likelihood of occurrence of a malfunction of a structure, system or component important to safety previously evaluated in the Final Safety Analysis Report as updated." This conclusion is based on a combination of factors, the adverse thermal-hydraulic conditions coupled with inadequate upper tube bundle support, which caused the steam generator failure. SONGS did not believe they violated this criteria even though SONGS was aware that certain calculations pertaining to stability ratios flow velocity looked wrong. The former Deputy Regional Administrator said that SONGS exercised engineering judgment and decided that the values were acceptable. He noted that there is no requirement that defines the value of the void fraction.

The former Deputy Regional Administrator added that the AIT follow-up report addressed the flow velocity and thermal-hydraulic conditions as unresolved items, which were to be dispositioned through the escalated enforcement process. While the AIT report addresses these issues, the report did not reach a conclusion on the 50.59 violation even though he and some staff members concluded that the licensee violated 50.59 (2)(c)(ii). He noted that this issue was not pursued because of the 2.206 petition submitted to the NRC Petition Review Board by the Friends of the Earth. The petition posed the very question regarding whether the licensee violated 50.59 and the Petition Review Board has the responsibility to make a recommendation to the NRR Director who can then reach a decision on the issue.

The former Deputy Regional Administrator said that while he and some of the staff members involved in the AIT believed that SONGS violated 50.59 (2)(c)(ii) during its' implementation of the 50.59 process, other staff members did not share this view. Some staff felt the criteria was violated but that the licensee did not have control over this, therefore, the licensee should get discretion because of what they knew or did not know at the time. According to the former Deputy Regional Administrator, the staff's focus and emphasis was not so much on whether one could point to a single criteria, but whether or not it (the violation) was fair and reasonable and met the standards for discretion.

As noted under Issue 1, the former Deputy Regional Administrator said in hindsight, he believes that SONGS should have requested a license amendment from NRC prior to making the change. He also believes the steam generator design was fundamentally flawed and would not have been approved as designed.

The former Deputy Regional Administrator also stated that, ultimately, Region IV could not reach a conclusion on whether or not the licensee violated 50.59 because the Office of Investigation had an open investigation into whether the licensee had willfully violated 50.59, and because of the 2.206 petition. Region IV could not "get out in front" of the agency. The region decided that the Petition Review Board had the responsibility to disposition the matter. He said that in the end, the AIT identified a design control violation.

Former Region IV Regional Administrator

The former Region IV Regional Administrator told OIG that because the event surrounding the SONGS steam generator tube degradation was unprecedented in the industry, Region IV immediately established an AIT. Also, there was Congressional criticism that SONGS should have obtained a license amendment to replace the steam generators and so it was important to review the issue as early as possible so that Region IV could draw a conclusion as to whether there was something amiss with respect to the 50.59 process and how the licensee had implemented the steam generator design change. His intent was for the AIT to conduct a thorough review and reach solid conclusions. He recalled being briefed by the AIT after the team completed its inspection and he concurred on the AIT report.

According to the former Regional Administrator, the AIT conducted a thorough review, identified significant issues, and reached defensible conclusions. The AIT had a large area to cover and looked at a number of items, including fabrication, transportation, and installation of the steam generators. The AIT may have conducted a focused 50.59 because NRC rarely, if ever, conducts a 100-percent review. Consequently, the AIT could have very easily selected items they viewed as important aspects to review to determine if the licensee reached the right conclusion. In his view, the AIT focused on design issues and the 50.59 process is not intended to identify design issues.

The former Regional Administrator was not aware that the AIT did not review all the methodology changes in the SONGS 50.59 steam generator replacement process. He was aware that the AIT has raised methodology-type questions because some of it surfaced in the AIT report and that the team considered methodology changes. However, if the region missed some of the methodology changes it was because inspections have always been no more than a sampling. If the AIT did not focus on the methodology changes, it was because there was something about their approach, plan, and scope of review, coupled with guidance they received that took them in the direction they took. It was not malevolent or intent, but a part of the mentality and process of how inspectors pick their sample and selection process.

Current Region IV Deputy Regional Administrator

The current Region IV Deputy Regional Administrator said that based on what the NRC looked at during its inspections, the agency made definitive statements that the licensee did not require a license amendment. However, he acknowledged there could be other aspects of the 50.59 that were done incorrectly that would require or would have required a license amendment. He said that without additional inspection, NRC does not know the answer. He said to make a definitive decision on whether a license amendment request was required, the agency would have to talk about the resources needed to accomplish that. He said, "It comes down to a prudent use of resources to go back and accomplish that."

The Deputy Regional Administrator stated with SONGS it was an error with code, a design issue – like an error carried forward-type of issue. The issue was a model error

that never got caught. He does not believe the licensee's 50.59 evaluation would have picked it up. He also doubts the NRC license amendment review process would have picked this up. If the licensee explains the model used and reports the value reached, NRC may accept the output. The NRC review process is not going to identify an error that the licensee made in either the modeling or the inputs to the modeling or the assumptions that went into the modeling.

Interviews of Headquarters Managers

Former NRR Director

The former NRR Director said he was not familiar with the AIT inspection and whether a member of his staff assisted the AIT (the NRR project manager). He was not aware of the focus of the AIT or direction given to the AIT. He said it appeared that the project manager also sampled and identified two issues for AIT follow up, one of which was a minor violation.

The former NRR Director noted that whether the NRC should have conducted a much more thorough review because of external stakeholder interest is a different question and should have been a management decision. However, from a safety significant standpoint, the answer would have been that it did not warrant a more thorough review. He noted that there was no release offsite that was consequential to anyone.

Interview of NRR Acting Director

The Acting NRR Director told OIG the region does not have latitude to deviate from the 50.59 rule [similar versus intended use]. But, in this case, it is NRC's job to have the licensee provide the justification, as the licensee is responsible for doing the 50.59 evaluation.

The Acting NRR Director informed OIG that the examples cited by the licensee in the AIT followup report (as described in footnote 32), which included three NUREG contractor reports, are reports of research that have been done for the NRC Office of Nuclear Regulatory Research and do not constitute NRC approval. They were examples of how the NRC used the code for a vessel head, and dissimilar welds, which are good uses of ABAQUS, but they are not steam generator tube bundle interactions with tube support plates. His inference in reading the next paragraph of the AIT followup report was that inspectors looked at Comanche Peak's FSAR and recognized SCE's examples were not NRC approvals and they looked for another analog and presented the Comanche Peak analysis of ABAQUS. He stated it is debatable if Region IV found the best application to cite in closing the open URI 10 issue.

With specific regard to Region IV's closeout of URI No. 10 and whether the basis used was consistent with 10 CFR 50.59, the Acting NRR Director advised there could probably be a diversity of views from the staff on this because ABAQUS and ANSYS are both generic, widely-used finite element analysis codes. He was not certain he agrees with the region's position that the use of ABAQUS was a change of

methodology; his read of the 50.59 rule and that understood by his staff members is that the change to use ABAQUS constitutes a change in element of methodology.

The Acting NRR Director explained that if a modification change is reflected in the post-modification FSAR, there should be somewhere in the paper trail whether a screen out or in, or an evaluation was conducted. There should be some indication of how the change was assessed against 50.59 criteria, and the results of that assessment indicating if the change met or did not meet the 50.59 criteria. He stated it is possible the items that were not addressed by either the 2009 or AIT inspections were not reviewed, or not selected as a sample inspection. Based on the gaps that may exist regarding items that may require screening and/or evaluation, he could not make an overall determination that a license amendment was not required for the replacement steam generators at SONGS. Likewise, he could not conclude that an amendment was required. He said there are reasonable questions that should be evaluated as part of 50.59 and we do not know if the questions were addressed. Until those items, evaluations, are completed, he cannot conclude either way if an amendment was required. He can conclude for the evaluations inspected, "generally yes," an amendment was not required.

The Acting NRR Director did not believe the NRC license amendment review process would have caught the problem at SONGS, especially given what was found regarding the fluid elastic instability in the secondary side of the steam generator. He said the trigger to require a license amendment is intended to focus on safety and not necessarily to avoid a bad investment by the licensee. The safety outcomes of this event were well within the licensing basis of the facility and were a low-consequence event in terms of public exposure impacts. The result was not a significant safety impact. In the end, SONGS had a tube leak that was well within the design basis accident analysis. And it was not clear to him that the analysis that supported the design would have driven the NRC to a conclusion that would have identified and anticipated the wear identified in the secondary side.

The Acting NRR Director said that industry has replaced the vast majority of steam generators on pressurized water reactors under 50.59 from the late 80's and early 90's forward, and up until SONGS, these replacements have occurred without issue.

Deputy Executive Director for Reactor and Preparedness Programs

The Deputy Executive Director told OIG that the complex issues with the SONGS replacement steam generators are problems the NRC has not previously witnessed. Had SCE submitted an amendment for review, the NRC would have touched those issues that resulted in the flaws in that generator (which experienced the tube leak). He further explained that a 50.59 review (inspection) is not a safety review and that the design problem should have been found by the licensee. Hypothetically, he stated the NRC could have potentially found the problem in the licensing review process; but the 50.59 would not be the process to find that. The Deputy Executive Director told OIG the 50.59 process is utilized to determine if the NRC is required to

review a change proposed by the licensee or if the NRC relies on the licensee's review of the change.

With regard to the closeout of URI 10 concerning the use of ABAQUS, the Deputy Executive Director stated it is ultimately the region's responsibility to close out the URI. The inspector determined the NRC had approved ABAQUS for the reactor coolant system structural integrity analysis and without more information he could not provide an answer regarding the adequacy of the region's closure.

Findings

OIG found that although Region IV AIT, established to assess the circumstances surrounding the tube leak and unexpected wear of tubes in the Unit 3 steam generators, included a review of the SONGS 50.59 steam generator package to determine whether SONGS needed a license amendment prior to installing the new steam generators, the AIT did not document an answer to this question. In its initial July 18, 2012, inspection report, the AIT communicated that the NRR Project Manager assigned to perform the review identified one unresolved item (URI number 10, "change of methodologies associated with 10 CFR 50.59 review") for which additional information was needed to determine if performance deficiencies exist or if the issues constituted violations of NRC requirements. The URI described two instances that failed to adequately address whether the change involved a departure of the method of evaluation described in the UFSAR. Although NRC's November 9, 2012, AIT followup report documented the closure of this URI, and stated that neither change would have required a license amendment, it did not answer the overall question of whether a license amendment was required.

The AIT Team Leader and the current Region IV Deputy Regional Administrator told OIG that based on what NRC reviewed during its inspections, the conclusion was that a license amendment was not needed, although each allowed that the sampling approach used to perform this assessment could have missed something. The Acting NRR Director said he could not determine if an amendment was needed or not due to the gaps that may exist regarding items that may require screening and/or evaluation. The current Region IV Deputy Regional Administrator said additional inspection would be required to answer whether a license amendment was required, and questioned whether it would be a prudent use of resources to go back and accomplish that. The former Region IV Deputy Regional Administrator said that in hindsight, he believes that SONGS should have requested a license amendment from NRC prior to making the change. He also believes the steam generator design was fundamentally flawed and would not have been approved as designed. He said the AIT discussed a potential 50.59 criteria violation because of the design issues; however, the AIT ultimately identified a design control violation.

OIG found that NRC's justification for closing out URI number 10 does not align with specific language in 10 CFR 50.59 concerning NRC approval for a change in methodology, but was based instead on Region IV's interpretation (in consultation with

NRR) of the rule. 10 CFR 50.59 (a)(2)(ii) reflects that changes from a method described in the UFSAR to another method are permissible without NRC preapproval if that method has already been approved by the NRC for the "intended" application. In closing out the URI, however, the AIT followup report determined the change of methods would not have required a license amendment based on NRC's approval for the use of the method at other nuclear power plants in "similar" applications. OIG notes that while the AIT characterized the issue as a change in methodology, it justified closing the matter based on approval for a "similar" application rather than the "intended" application as stated by the rule.

OIG also notes that while the AIT inspection report identified a URI pertaining to the SONGS 10 CFR 50.59 screen and evaluation package, the NRR technical specialist who reviewed this used a sampling approach and did not identify many of the shortcomings described under issue 1 of this report.

ISSUE 3: NRC Oversight of SONGS UFSAR

Background

10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Section 50.34, "Contents of Applications; Technical Information," contains requirements for the content of applications for construction permits and operating licenses for nuclear power reactors. Per the regulation, an application for a construction permit must include a preliminary safety analysis report (SAR), and an application for an operating license must include a final SAR (FSAR). Section 50.34 states that the FSAR is to include information that describes the facility, presents the design bases and the limits on its operations, and presents a safety analysis of the structures, systems, and components, and of the facility as a whole. The FSAR and the plant's license and associated technical specifications are the principal regulatory documents describing how the plant is designed, constructed, and operated. The FSAR is a key reference document used by NRC inspectors during plant construction and operation.

In 1980, NRC issued the FSAR update rule, 10 CFR 50.71(e), to ensure that licensees maintain the information in the UFSAR to reflect the current status of the facility and address new issues as they arise, so that the UFSAR can be used as a reference document in safety analyses. Information to be maintained includes all changes made in the facility or procedures as described in the FSAR; all safety analyses and evaluations performed by the licensee either in support of approved license amendments or in support of conclusions that changes did not require a license amendment. 10 CFR 50.71(e) specifies the type of information that must be submitted and states that licensees must submit a UFSAR update annually or within 6 months after each refueling outage provided that the interval between successive updates does not exceed 24 months.[36]

[36]As noted in the background and chronology section of this report, licensees have similar reporting requirement (every 24 months) for activities implemented under 10 CFR 50.59.

Inspections in the 1996-1997 timeframe by NRC and licensees identified numerous discrepancies between updated FSAR information and the actual plant design and operation, and these findings raised questions about possible noncompliance with 10 CFR 50.71 (e). In June 1999, NEI issued NEI 98-03, "Guidelines for Updating Final Safety Analysis Reports," to provide licensees guidance for updating FSARs consistent with the requirements of 10 CFR 50.71 (e). In September 1999, NRC published Regulatory Guide 1.181[37] "Content of the Updated Final Safety Analysis Report in Accordance with 10 CFR 50.71(e)," which endorsed NEI 98-03.

During this same period of time, the NRC promulgated the revised 10 CFR 50.59 rule. Consistent with the requirements of 10 CFR 50.59(d)(2), the licensee is required to submit a summary description of any changes to the facility as described in the FSAR that require an evaluation using the criteria defined in 10 CFR 50.59(c)(2). This report is required to be submitted to NRC on a not-to-exceed 24 month frequency, and is a standalone report and different from the UFSAR reporting provided to the NRC under 10 CFR 50.71(e).

NRC Oversight Responsibility for UFSAR and 59.59 Report Reviews

NRC does not have a specific ROP inspection for assessing whether licensees are appropriately maintaining UFSARs; however, the agency has two primary means for providing oversight of UFSARs. First, embedded in certain ROP inspections are requirements to verify that licensing basis documents are updated appropriately. For example, IP 71111.17, *Evaluations of Changes, Tests, and Experiments and Permanent Plant Modifications*, directs inspectors to verify that license basis documentation have been updated accordingly and are still consistent with the new design. An example identified was the UFSAR. Another example includes IP71111.18, *Plant Modifications,* which directs inspectors to verify that design and licensing documents have either been updated or are in the process of being updated to reflect the modifications. Examples of design documents which could be affected by modifications include the UFSAR.

The second primary means for providing oversight of UFSARs is provided by NRR project managers,[38] who are required per the NRR Division of Operating Reactor Licensing (DORL) Handbook[39] to perform a review of UFSARs within 90 days of receipt

[37] NRC Regulatory Guides are issued to describe and make publicly available such information as methods acceptable to the NRC staff for implementing specific parts of NRC's regulations, techniques used by the staff in evaluating specific problems or postulated accidents, and data needed by the NRC staff in its review of applications for permits and licenses.

[38] NRR Office Instruction LIC-100, Revision 1, states that project managers generally coordinate NRR staff efforts for an assigned facility, a generic issue, or a policy issue to ensure that the outputs are complete, accurate, and timely. Project managers also serve as the point of contact with licenses for assigned facilities and they are generally responsible for managing the licensing agenda for assigned facilities and resolving issues about licensing bases for assigned facilities. The NRR Division of Operating Reactor Licensing (DORL) Handbook, states that the PM serves as the licensing authority regarding the maintenance and amendment of a site's licensing and design basis.

[39] The DORL Handbook is an online NRC resource intended to provide easy access to NRC regulations, procedures and documents in order to help NRR Project Managers, Licensing Assistants, and others complete various licensing actions and tasks.

to, among other tasks, check that the UFSAR revisions includes the following, as applicable:

- New regulatory requirements.
- Changes to the facility or procedures. (Per NEI 98-03, [40]this includes changes implemented under 10 CFR 50.59.)
- Analysis of new safety issues.
- Long-term temporary modifications.
- Discrepancies between the facility and the UFSAR.

These expectations are listed in guidance titled "UFSAR Changes – 10 CFR 50.71 (e)," located within the "Design Bases" section of the DORL Handbook. The guidance (under project manager "actions") also states that the results of the project manager's review are to be documented by a memorandum to file and that if there are any significant findings, the project manager should consult with regional representatives for possibly including findings in an inspection report. The guidance also includes an "additional guidance" section, which states that any exceptions to the 90-day review requirement should be negotiated with the respective project director and estimates that the project manager's review of UFSAR changes should take approximately 8 hours. The "additional guidance" section also states that the review should "determine that, for those FSAR update changes that the project manager is familiar with, these changes are appropriately addressed by licensing actions (changes to the facility or procedures previously described in the FSAR), 10 CFR 50.59 submittals, or regional inspection activities." It also states, "a representative sample should be chosen to perform this review."

OIG noted that a different DORL Handbook section, titled "50.59 Evaluations," specifically describes the project manager's role in reviewing updated FSARs for changes subsequent to 50.59 evaluations during the project manager's review of updated FSARs. The guidance states:

> Under the provisions of 10 CFR 50.59, licensees are permitted to make changes to the facility and procedures, as described in the safety analysis report (SAR), and to conduct tests or experiments not described in the SAR, without prior NRC approval, provided a change to the technical specifications is not involved or the proposed change, test or experiment does not meet the criteria of 10 CFR 50.59(c)(2). Licensees must maintain records of such changes, supported by a safety evaluation which provides the basis for determining that the change, test, or experiment does not meet the criteria of 10 CFR 50.59(c)(2) and report such changes to the NRC in accordance with 10 CFR 50.59(d)(2). A license amendment must be prepared for changes that meet the requirements of 10 CFR 50.59(c)(2).

[40] Revision 1 of NEI 98-03, "Guidelines for Updating Final Safety Analysis Reports", dated June 1999, provides methods that are acceptable to the NRC staff for complying with the provisions of 10 CFR 50.71(e).

Under the current Reactor Oversight Process (ROP), Region-based inspectors have been given the responsibility to perform an inspection module/procedure on facility changes made by licensees without prior NRC approval in accordance with 10 CFR 50.59. Consequently, DORL Project Managers do not directly review the 50.59 screens or evaluations. However, DORL Project Managers are responsible for the review of those changes to the UFSAR not requiring prior NRC approval as part of the project manager review done of the summary reports provided under 10 CFR 50.71(e).

OIG Review of NRR Oversight of SONGS UFSAR and 50.59 Submittals

OIG compared the number of UFSARs submitted by SONGS to NRC between 2001 and 2011 with the number of documented NRR reviews of those submittals and learned that while SONGS submitted six updates during this timeframe, NRC could provide documentation to support two NRR reviews of the six submittals. One review, documented in a memorandum dated December 31, 2012, reflected that an NRC Project Manager reviewed a June 10, 2011,[41] updated FSAR submittal from SONGS and found the submittal met 10 CFR 50.71(e) requirements. The memorandum stated that the review encompassed a sample of potential changes to the UFSAR as a result of license amendments to ensure the revised UFSAR reflected those changes. The memorandum had no reference to the other tasking areas (for example, the 50.59 changes or new regulatory requirements) as being reviewed by the Project Manager.

The other memorandum, dated November 15, 2001, documented a limited review of five licensing actions completed during the period of time covered by the licensee's UFSAR revision. The Project Manager who conducted the review verified that two of the five licensing actions affected the information in the UFSAR and the changes were reflected in the UFSAR. Similarly, this memorandum had no reference to the other tasking areas (for example, the 50.59 changes or new regulatory requirements) as being reviewed by the project manager.

OIG Review of NRR Oversight of Other Updated UFSAR Submittals

OIG determined between April 2010 and March 2014, two NRR branches received updates for 21 nuclear power plants. Of the 21 submittals, 5 reports were reviewed by NRR within the 90-day timeframe specified in the DORL Handbook, 7 reports were reviewed between 90 days and a year after receipt, and 9 reports were reviewed more than a year after receipt.

[41] OIG learned that although SONGS turned in its April 2009 update on June 10, 2009, the NRC Document Control Desk rejected the submittal and SONGS allegedly did not resubmit an acceptable format for ADAMS. A note in NRR's files, dated February 15, 2011, stated the Project Manager would wait until the April 2011 update to perform a UFSAR review.

Additionally, OIG noted that 2 of the 21 nuclear power plants that were reviewed by NRR had a reference to 50.59 evaluations, whereas 3 of the 21 specifically stated that "no review" of 50.59 was done and 16 of the 21 had no discussion of 50.59.

OIG Interviews of NRR Staff

The NRR Project Manager who wrote the December 2012 memorandum documenting review of the SONGS June 10, 2011, UFSAR, told OIG that he was tasked in the October/November 2012 timeframe, by an NRR Branch Chief to conduct the review because it had not been reviewed for a while. The Project Manager had recently been assigned to SONGS and had no previous experience with the station. To conduct the review, the Project Manager pulled all license amendments from 2002 forward, took a random sampling, and compared them to the FSAR. He recalled only one discrepancy between the facility and the FSAR, which pertained to power level. The project manager did not compare the 50.59 change report to the FSAR and said that as a project manager he would not typically do a 50.59 review. He thought that another NRR group, the Generic Communications Branch, reviewed changes under 50.59. The Project Manager said he did not question the multiple methodology changes that OIG identified in Section 3.9 of the 2011 updated FSAR as discussed under Issue I of this report. He said, "I didn't specifically go page by page looking for change bars and then work backwards. I worked from the license amendments and moved into the FSAR for review. That was really where my focus was."

The Project Manager said that the UFSAR reviews by project managers are a low priority and he was not sure if they could be given a higher priority because project managers have a lot of work already. With regard to the 10-year period in which no review was documented by NRR of SONGS' UFSARs, the Project Manager said that a lot of changes occur over such a timespan and a reviewer will likely miss some of them because "the change bars roll off from one year or one change to the next."

A different NRR Project Manager who was responsible for SONGS in 2009 told OIG there is a general expectation that the project managers review updated FSARs upon receipt. However, he believed there were inconsistent practices within NRR as to the level of review. He believed project managers who completed reviews documented them in a memorandum to file. Although he remembered receiving the 2009 and 2011 FSARs from SONGS, he did not remember doing a review for either one. He was not aware if the SONGS Project Manager before him reviewed or documented a review. He said that even if there is some guidance to project managers on these reviews, it was his impression from talking to peers, that the UFSAR reviews were not consistently performed. He was not sure if this was a conscious decision by project managers or if the requirement was not reinforced by management. He thought the review was considered a low-value activity.

As far as the 50.59 summary document submitted by the licensee, this Project Manager described the reports as being brief and containing a summary of the licensee's basis for determining that the change can be made under 50.59. He was not aware nor had

he done a formal review of those 50.59 documents. He believed they were used as a vehicle to communicate with regional inspectors to identify any areas of concern. He said project managers used to have just one site to monitor, but since the 1990s, project managers have multiple sites. With one site, he said, the project managers had more opportunity to better understand the licensing basis for a plant and to assist with onsite inspections of the licensee's 50.59 activities. Today, regional inspectors implement 50.59 inspections in the course of their "core" inspections and NRR project managers are not involved in the process.

An NRR Branch Chief involved with SONGS learned from a Project Manager that the SONGS UFSAR review had not been performed for more than a year. The previous NRR Branch Chief tasked the Project Manager to conduct the review of the UFSAR submitted by SONGS in 2011. He did not think the 10 CFR 50.59(d)(2) submittal had been included in the project manager review. He stated the Project Manager had done a "comprehensive" review of the document sometime in the June through November 2012 timeframe. He stated the Project Manager identified all the changes, including going back to previous changes not reviewed, and documented his review. It was his understanding that the only new information in the steam generator section of the 2011 UFSAR was related to the technical specifications. Additionally, he discussed the process that is generally followed. He described that headquarters program managers review the UFSAR submittals by the licensees to understand the changes made. He said they review the 10 CFR 50.59(d)(2) submittals to make sure it makes sense and a license amendment was not required. If necessary, the headquarters project managers contact the region and pursue a more detailed evaluation.

OIG interviews of NRC Senior Managers

Former Region IV Deputy Regional Administrator

The former Deputy Regional Administrator told OIG that during the AIT, Region IV staff reviewed the original SAR and noted that the licensee had made many changes to the steam generators over a 25-year period, which were no longer reflected in the UFSAR or consistent with the original SAR. When a licensee then goes to replace the steam generators, they are then comparing to whatever existed just before the replacement. All the changes have already occurred and were never updated [in UFSAR].

Current Region IV Deputy Regional Administrator

The current Region IV Deputy Regional Administrator, stated that his general expectation is that all material submitted to the NRC from a licensee would be reviewed by headquarters staff. He said region staff does not review the UFSAR except during periodic 50.59 inspections. He said the UFSAR is important to regional inspectors during inspections because it describes the licensing and design basis of nuclear power plants.

Former NRR Director

The former NRR Director advised OIG that he expected project managers to review revisions the UFSAR submitted by licensees under the 10 CFR 50.71(e) process and verify that changes made by licensees through various processes such as the 50.59 evaluations, license amendments, and licensee commitments, have generally been updated into the UFSAR. The project manager should document the review, which usually should take anywhere from 60 to 90 days.

Regarding OIG's observation that the SONGS FSAR was reviewed twice during an 11-year period and that review of the 2011 submittal was completed in December 2012, the former NRR Director acknowledged that this was unacceptable to go for such a long period of time without FSARs being reviewed.

Regarding the NRR staff's review of FSARs submitted by other nuclear power plants, the former NRR Director said NRC should either change the requirement to complete such reviews within 90 days or do a better job to accomplish the requirement. The FSAR review is a self-imposed requirement and if the agency was not meeting its own internal guidance, then the agency should change the guidance and consider what really makes sense based on safety significance. He noted that there was nothing significant about completing the review in 90 days. He would need to review the safety benefit of doing the FSAR reviews and whether there was a better periodicity for doing these reviews. The former NRR Director said that the staff should review the issue and decide whether it makes sense to conduct the reviews on a yearly basis or every 2 years and develop a mechanism for tracking such reviews.

The former NRR Director said that the project manager's review of the UFSAR is an administrative task. Project managers should know all the license amendments that have been submitted over the past 18 months and ask themselves if the amendments affected the FSAR and if so, confirm that these changes are reflected in the FSAR. He noted that this review is a bookkeeping exercise and it is not a technical exercise. The former NRR Director said the technical review was completed when the staff reviewed the license amendment request. Regarding project manager review of the 50.59 (d)(2) licensee submittals, the former NRR Director told OIG that the review is also an administrative review and more or less based on the experience of the project manager. The project manager should question whether the 50.59 changes made sense, whether there was any question as to why the change was made under the 50.59 process, and why the change did not trigger a license amendment request. He noted the project manager may question whether there was a need to follow up on an issue with a resident inspector or from an inspection standpoint. Such questions are kind of a judgment call made by project managers when they review their list of 50.59 changes. Examining whether a change should have screened in for evaluation would require a more in-depth review to look at what was done behind the 50.59 (criteria i-viii).

Deputy Executive Director for Reactor and Preparedness Programs

The Deputy Executive Director told OIG that NRC oversight of 10 CFR 50.71(e) is critical since it enables the NRC to know whether or not a plant is in compliance with its licensing basis. He added the purpose of 10 CFR 50.71(e) is to ensure that changes either approved by NRC or made by licensees made under 10 CFR 50.59 process are captured in the UFSAR.

He considers it a priority to review the UFSAR. Because it is not a baseline inspection in ROP, headquarters project managers are tasked with reviewing the 50.71(e) reports submitted by licensees. If a project manager finds an issue, the process is for the project manager to contact the branch chief and get inspection follow-up on this issue. The Deputy Executive Director thought that project managers were checking the 10 CFR 50.59(d)(2) reports to assess whether 50.59 changes are in the UFSAR.

Findings

OIG found that NRC does not consistently use one of its primary oversight methods to assess whether licensees are keeping their power plant licensing basis documentation up to date as required by 10 CFR 50.71(e). Although licensees are required, per 10 CFR 50.71(e), to biannually submit UFSAR updates reflecting the current status of the facility so that the document can be used as a reference document in safety analysis, the NRR project managers tasked to review these submittals do not always conduct the reviews within the required 90-day timeframe. Moreover, although licensees also must biannually submit, per 10 CFR 50.59(d)(2), information concerning changes made under 10 CFR 50.59 without NRC prior approval, NRR project managers – who are instructed to consider this information during their review of 10 CFR 50.71(e) submittals – do not always take the 10 CFR 50.59(d)(2) information into consideration during their reviews. OIG found that while NRC expects a plant's UFSAR to accurately reflect a plant's licensing basis, the former Region IV Deputy Regional Administrator said that during the SONGS AIT, Region IV staff noted the licensee had made many changes to the steam generators over a 25-year period that were not reflected in the UFSAR or consistent with the original SAR.

OIG reviewed documentation of project manager reviews in two NRR branches and found project managers reviewed only 5 of the 21 most recently received licensee UFSAR submittals within the 90-day timeframe, while 7 were reviewed between 90 days and a year after receipt, and 9 reports more than a year after receipt. Moreover, only two of the project manager reviews contained a reference to review of 10 CFR 50.59 documentation submitted by licensees even though project manager guidance directs that this occurs. OIG also found that over a 10-year period, NRC staff documented two reviews of changes to SONGS' UFSAR, although the licensee submitted six UFSAR updates during this period as required, and neither NRC review mentioned consideration of 10 CFR 50.59 changes.

Although senior NRC managers expect the project managers to conduct the reviews within the required timeframe, and to consider changes made under 10 CFR 50.9 as part of that review, two NRR project managers interviewed said the reviews are considered a low priority. Neither of the project managers included the 10 CFR 50.59 information in their reviews of 50.71(e) submittals; one thought this review was conducted by a different NRR group and the other thought the 10 CFR 50.59 information was used by regional inspectors for a different purpose.

In contrast, the Deputy Executive Director for Reactor Preparedness Programs considers NRC's oversight of 10 CFR 50.71(e) to be critical for enabling NRC to know whether a plant is in compliance with its licensing basis, and considers the project manager review of 50.71(e) submittals to be a priority. While the former NRR Director also expected project managers to conduct the required reviews to assess whether changes made by the licensees have generally been updated into the FSAR, he viewed the project manager's review as a bookkeeping exercise that is based on the experience of the project manager. He noted that the FSAR review is a self-imposed requirement and if NRC is not meeting its own internal guidance, then it should either meet the requirement or change the guidance based on safety significance.