UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 EAST LAMAR BOULEVARD
ARLINGTON, TEXAS 76011-4511

July 9, 2019

EA-18-155

Mr. Doug Bauder
Vice President and Chief Nuclear Officer
Southern California Edison Company
San Onofre Nuclear Generating Station
P.O. Box 128
San Clemente, CA 92674-0128

SUBJECT: NRC SUPPLEMENTAL INSPECTION REPORT 050-00206/2018-006, 050-00361/2018-006, 050-00362/2018-006, 072-00041/2018-002

Dear Mr. Bauder:

This letter refers to a supplemental inspection using the U.S. Nuclear Regulatory Commission's (NRC's) Inspection Procedure 92702, "Follow-up on Traditional Enforcement Actions," conducted on January 28 through February 1, February 11-15, March 19, March 21-23, and April 10-13, 2019, at your facility in San Clemente, California. The inspection continued with in-office reviews of information provided by your staff from November 2018 through May 17, 2019.

The NRC performed this inspection to review corrective actions taken by the Southern California Edison Company in response to the misalignment of a loaded spent fuel storage canister as it was being downloaded into a storage vault at San Onofre Nuclear Generating Station (SONGS). Our initial review of the incident was documented in NRC Special Inspection Report 050-00206/2018-005, 050-00361/2018-005, 050-00362/2018-005, 072-00041/2018-001 and Notice of Violation (NRC's Agencywide Documents Access and Management System (ADAMS) Accession ML18341A172) and finalized in NRC letter "Notice of Violation and Proposed Imposition of Civil Penalty - $116,000 and NRC Inspection Report 050-00206/2018-005, 050-00361/2018-005, 050-00362/2018-005, 072-00041/2018 001," (ADAMS Accession ML19080A208).

The enclosed report documents the results of the supplemental inspection. The inspectors discussed the preliminary inspection findings with you and members of your staff on February 15, 2019, at the conclusion of a portion of the onsite inspection. A final exit briefing was conducted telephonically with Mr. Al Bates, Regulatory and Oversight Manager, and members of your staff on June 13, 2019.

The NRC performed this supplemental inspection to determine if: (1) the root and contributing causes of the significant performance issues were understood, (2) the extent of condition and extent of cause for the significant performance issues were identified, (3) the corrective actions taken to address and preclude repetition of significant performance issues were prompt and effective, and (4) the corrective action plans direct prompt actions to effectively address and

preclude repetition of significant performance issues. Additionally, the inspection team reviewed and determined if follow-up items from the NRC Special Inspection had been completed.

The NRC determined that your staff's causal evaluations to address the previously issued violations were adequately performed to the depth and breadth required. The NRC noted that your staff's evaluations identified that the primary root cause of the Severity Level II violation for failure to provide redundant lift protection features during downloading operations was that management failed to recognize the complexity and risks associated with a long duration fuel transfer campaign using a relatively new system design. Your staff determined that the primary cause for the Severity Level III violation for failure to make a report to the NRC was that management failed to recognize the required integration and application of 10 CFR Part 72 reporting requirements.

The NRC determined that your staff identified and implemented appropriate corrective actions to revise loading procedures, revise the reportability program, utilize equipment enhancements, require adequate training, enhance oversight of operations, and enhance the corrective action program at SONGS. The NRC also determined that your staff's extent of condition and extent of cause evaluations adequately reviewed whether other operations were susceptible to similar performance deficiencies. However, even though your causal evaluations and corrective actions were comprehensive, the NRC staff identified four observations associated with the evaluations and corrective actions.

Based on the results of the supplemental inspection, the NRC identified five findings that were identified as violations of NRC requirements and were determined to be Severity Level IV violations of low safety significance under the traditional enforcement process. The NRC is treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2.a of the NRC Enforcement Policy.

If you contest the violations or significance of the NCVs, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with copies to: (1) the Regional Administrator, Region IV, and (2) the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter, its enclosure, and your response if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from ADAMS. ADAMS is accessible from the NRC's Website at http://www.nrc.gov/reading-rm/adams.html. To the extent possible, your response should not include any personal privacy or proprietary information so that it can be made available to the Public without redaction.

If you have any questions regarding this inspection report, please contact Lee Brookhart at 817-200-1549, or the undersigned at 817-200-1223.

Sincerely,

Greg Warnick, Chief
Reactor Inspection Branch
Division of Nuclear Materials Safety

Docket Nos.: 050-00206; 050-00361;
050-00362; 072-00041
License Nos.: DPR-13; NPF-10; NPF-15

Enclosure:
Supplemental Inspection Report
050-00206/2018-006; 50-00361/2018-006;
050-00362/2018-006; 072-00041/2018-002
w/Attachments:

1. Supplemental Inspection Information
2. Radiological Surveys of ISFSI pads

**U.S. NUCLEAR REGULATORY COMMISSION**

**REGION IV**

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|---|---|
| Docket Nos.: | 50-206; 50-361; 50-362; 72-041 |
| License Nos.: | DPR-13; NPF-10; NPF-15 |
| Report No.: | 050-00206/2018-006; 050-00361/2018-006; 050-00362/2018-006; and 072-00041/2018-002 |
| EA No.: | 18-155 |
| Licensee: | Southern California Edison Company |
| Facility: | San Onofre Nuclear Generating Station |
| Location: | San Clemente, CA 92674-012 |
| Inspection Dates: | Onsite: January 28 - February 1, 2019; February 11 - 15, 2019; March 19, 21 - 23, 2019; and April 10 - 13, 2019<br>In-office review from November 2018 through May 17, 2019 |
| Exit Meeting Date: | June 13, 2019 |
| Inspectors: | Lee Brookhart, Senior ISFSI Inspector<br>Reactor Inspection Branch<br>Division of Nuclear Materials Safety, Region IV<br><br>Eric Simpson, CHP, Health Physicist<br>Reactor Inspection Branch<br>Division of Nuclear Materials Safety, Region IV<br><br>W. Chris Smith, Reactor/ISFSI Inspector<br>Reactor Inspection Branch<br>Division of Nuclear Materials Safety, Region IV<br><br>Christopher Newport, Senior Resident Inspector<br>Project Branch A, Diablo Canyon<br>Division of Reactor Projects, Region IV |
| Accompanied by: | Janine F. Katanic, PhD, CHP, Acting Branch Chief<br>Fuel Cycle and Decommissioning Branch<br>Division of Nuclear Materials Safety, Region IV |
| Approved By: | Greg Warnick, Chief<br>Reactor Inspection Branch<br>Division of Nuclear Materials Safety, Region IV |
| Attachments: | 1.) Supplemental Inspection Information<br>2.) Radiological Surveys of ISFSI Pads |

## EXECUTIVE SUMMARY

### NRC Supplemental Inspection Report 050-00206/2018006; 050-00361/2018006; 050-00362/2018006; and 072-00041/2018-002

On January 28 through February 1; February 11-15; March 19; March 21-23; and April 10-13, 2019, the U.S. Nuclear Regulatory Commission performed an announced on-site Supplemental Inspection of the Independent Spent Fuel Storage Installation at the decommissioning San Onofre Nuclear Generating Station in San Clemente, California. The inspection continued with an in-office review of the licensee's analyses, procedures, and other materials gathered and provided prior to and after the on-site portion of the inspection through May 17, 2019.

The scope of the inspection was to evaluate and review the licensee's follow-up investigation, causal evaluations, implemented corrective actions, and planned corrective actions associated with violations described in the NRC's Special Inspection Report 050-00206/2018-005, 050-00361/2018-005, 050-00362/2018-005, and 072-00041/2018-001 and Notice of Violation (NRC's Agencywide Documents Access and Management System (ADAMS) Accession ML18341A172) and Notice of Violation and Proposed Imposition of Civil Penalty - $116,000 and NRC Inspection Report (ADAMS Accession ML19080A208).

The NRC determined that the licensee's causal evaluations were conducted to a level of detail commensurate with the significance of the problems and reached reasonable conclusions as to the root and contributing causes of the event. The NRC determined that completed or planned corrective actions were comprehensive and sufficient to address the performance issues that led to the previously identified violations.

Additionally, the inspectors identified five Severity Level IV, non-cited violations that involved failures to: (1) ensure appropriate quality standards on new equipment for downloading/withdrawal operations; (2) ensure purchased material conformed to the procurement documents for load sensing shackles; (3) ensure the loaded transfer cask and its conveyance was evaluated under the site-specific design basis earthquake; (4) provide adequate written basis for the initial 10 CFR 72.48 scratch evaluation; and (5) request the certificate holder to obtain a Certificate of Compliance amendment for use of the intermediate shelf in the spent fuel pool.

Follow-up on Traditional Enforcement Actions, Inspection Procedure 92702

- The inspectors independently reviewed the licensee's causal evaluations for the performance issues and significant findings that led to the August 3, 2018, misalignment incident. The NRC concluded that the evaluations were conducted to a level of detail commensurate with the significance of the problems and the root causes combined with the contributing causes adequately addressed the findings presented in the NRC Special Inspection Report. The inspectors also concluded that the root and contributing causes of the significant performance issues were understood by the licensee. One observation was identified by the NRC which related to the licensee's contributing causes. Subsequently, the licensee addressed and resolved the NRC observation by implementing additional corrective actions. (Section 1.2.1)

- The inspectors determined that the licensee evaluated the performance issues using systematic methodologies to identify root and contributing causes. The inspectors concluded that the licensee's causal evaluations addressed the extent of condition and extent of cause of the issues and appropriately considered safety culture traits. One observation was identified by the NRC regarding the licensee's extent of condition evaluation. Subsequently, the licensee addressed and resolved the issue by implementing additional corrective actions. (Section 1.2.2)

- The NRC concluded that the licensee's evaluations and corrective actions taken in the areas of licensee oversight, procedures, training, equipment, corrective action program, and reportability were appropriate to prevent recurrence of prior inspection findings and violations and were adequately prioritized with consideration to risk significance and regulatory compliance. The inspectors concluded that the licensee's completed corrective actions in the areas of training, corrective action program, and procedures were adequate to restore compliance and prevent recurrence for the relevant violations issued in the NRC Special Inspection Report, dated December 19, 2018. (Section 1.2.3.b (1)-(6))

- During the NRC's review, the inspectors identified two additional observations and two violations of NRC requirements relating to the licensee's corrective actions. The two violations were related to the licensee's failure to establish measures to ensure appropriate quality standards were specified in design documentation in accordance with 10 CFR 72.146 and the licensee's failure to establish measures to ensure that purchased equipment conformed to the procurement documents in accordance with 10 CFR 72.154 for the recent enhancements to fuel canister transfer equipment. The licensee entered the findings into the corrective action program as action requests 1218-20333 and 1219-52380. The violations were determined to have a low safety significance and the Severity Level IV violations were treated as non-cited violations. Subsequently, the licensee addressed and resolved the NRC observations and violations by implementing additional corrective actions. (Section 1.2.3.c)

- The inspectors evaluated and concluded that the licensee's corrective actions were prompt and effective, and the licensee had adequately established appropriate quantitative or qualitative measures of success for the actions implemented to monitor the effectiveness of the corrective actions to prevent recurrence. (Section 1.2.4)

Follow-up of Events and Notices of Enforcement Discretion, Inspection Procedure 71153

- The NRC reviewed Licensee Event Report 2018-001-1 (ADAMS Accession ML18317A060), dated November 8, 2018, for the licensee's actions which led to the inadvertent disablement of redundant important-to-safety slings during downloading operations on August 3, 2018. The NRC inspectors reviewed all the implemented and planned corrective actions and found them to be adequate to restore compliance and prevent recurrence. This licensee event report is closed. (Section 2.2.1)

- The NRC reviewed Licensee Event Report 2018-002-0 (ADAMS Accession ML19050A170), dated February 14, 2019. The licensee notified the

NRC that previous operations utilizing the low-profile-transporter were performed outside the clearance limits calculated in the station's site-specific seismic analysis. The NRC inspectors reviewed all the implemented corrective actions and found them to be adequate to restore compliance and prevent recurrence. The licensee event report described that an analysis was still in progress to determine if past operations were acceptable. This licensee event report remains open, pending NRC review of the additional information. (Section 2.2.2)

- The NRC reviewed Licensee Event Notification 53858, dated February 2, 2019. The licensee notified the NRC that previous operations utilizing the vertical cask transporter had been performed, for short periods of time, outside conditions described in the station's site-specific seismic analysis. Specifically, the licensee prematurely removed the seismic restraint band prior to stack-up operations. The NRC inspectors reviewed all the implemented and planned corrective actions and found them to be adequate to restore compliance and prevent recurrence. This licensee event notification is closed. (Section 2.2.3)

- The inspectors documented a violation of Certification of Compliance 72-1040, Appendix B, Technical Specification 3.4.15, for the licensee's failure to conduct transportation operations in accordance with the station's site-specific seismic analysis. Specifically, the NRC identified, the licensee prematurely removed the seismic restraint band prior to stack-up operations during vertical cask transporter operations. The licensee entered the finding into the corrective action program as action requests 0219-88442, 0219-22465, and 0319-95843. The NRC determined that the finding was of low safety significance since the licensee had re-performed the seismic evaluations restoring compliance and demonstrated the canister and its conveyance would not have tipped-over or slid off the haul route during those transportation operations. This Severity Level IV violation was treated as a non-cited violation. (Section 2.2.4)

- As a follow-up to the Special Inspection Charter, the NRC reviewed the licensee's evaluation to analyze the potential effects of dropping a canister approximately 18 feet onto the base of the UMAX vault. The NRC agreed with the evaluation conclusion that the canister would not have breached had the canister fell to the bottom of the UMAX vault. Additionally, the NRC concluded that the canister would have continued to perform all safety functions, including structural, thermal, criticality control, and shielding. (Section 2.2.5.a)

- The licensee performed a change under the 10 CFR 72.48 process to evaluate and accept scratches from incidental contact during insertion and withdrawal operations on previously loaded and future canisters placed in the UMAX independent spent fuel storage installation. The licensee's subsequent written evaluation, based on in-situ visual assessments and statistical analyses of eight loaded canisters, was adequate to demonstrate that the proposed change would not affect the canisters' ability to meet the confinement design function and structural functions as specified in the Holtec Final Safety Analysis Report.

  The licensee's evaluation also demonstrated that American Society of Mechanical Engineers Section III code tolerances for wear were met and did not require a change to the storage system's technical specifications. The NRC utilized the data

obtained through the visual assessments to perform independent statistical assessments using several models that were appropriate for the sample size. The NRC concluded that the conclusion presented by the Southern California Edison Company was conservative and reasonably bounded the maximum anticipated scratch or wear depth resulting from routine operational activities. The NRC concluded the licensee's 10 CFR 72.48 change did not require prior NRC review and approval through an amendment request. (Section 2.2.5.b)

- The inspection results documented one violation of NRC requirements for the licensee's failure to include an adequate evaluation to support a design change in accordance with 10 CFR 72.48. The NRC identified that the licensee's original evaluations to allow scratching and gouging on canisters contained multiple errors and inadequacies, and the NRC determined that the calculation could not adequately bound the maximum possible scratch depth on a canister.

  The licensee entered the finding into the corrective action program as action requests 1218-11302 and 0219-96601. The NRC determined that the finding was of low safety significance since the licensee re-performed the written evaluation utilizing in-situ visual assessment and statistical analyses that calculated a maximum probable scratch depth, which provided an adequate basis for the determination that the change did not require NRC review through an amendment request. This Severity Level IV violation was treated as a non-cited violation. (Section 2.2.6)

- The NRC closed an Unresolved Item from NRC Inspection Report 07200041/2017-001 dated, August 24, 2018 (ADAMS Accession ML18200A400). The Unresolved Item was related to a 10 CFR 72.48 evaluation for the scenario of a hypothetical accident of the loaded HI-TRAC VW transfer cask contacting the sides and bottom of the spent fuel pool during the short period of time that a loaded multi-purpose canister was in an unconstrained condition on an intermediate shelf in the spent fuel pool.

  The inspectors determined one violation of NRC requirements occurred, for the licensee's failure to request the certificate holder to obtain an amendment prior to implementing a change in accordance with 10 CFR 72.48. The licensee's design change created the possibility of an accident of a different type than any previously evaluated in the Holtec Final Safety Analysis Report. The licensee entered the issue into the corrective action program as action requests 0718-10512 and 0617-86918. The NRC determined that the finding was of low safety significance since the accident condition had been analyzed and NRC approved in NUREG-0712 "Safety Evaluation Report related to the operation of SONGS Units 2 and 3, dated February 1981," and described in the San Onofre Nuclear Generating Station Decommissioning Safety Analysis Report. The licensee restored compliance by revising the loading procedures to no longer utilize the intermediate shelf in the spent fuel pool. This Severity Level IV violation was treated as a non-cited violation. (Section 2.2.7)

- The inspection team observed the licensee perform several dry run exercises utilizing a simulated canister. On January 28, 2019, the licensee successfully demonstrated operations utilizing the low-profile transporter to transport the simulated canister within the transfer cask to the independent spent fuel storage

installation pad while maintaining compliance with the station's site-specific seismic analysis. On February 14, 2019, the licensee successfully demonstrated removal of the transfer cask from the bottom of the spent fuel pool directly to the cask washdown pit without utilizing the intermediate shelf in the spent fuel pool.

On January 28-30, 2019, the inspection team observed the licensee implementing all the corrective action enhancements to download and retrieve a simulated canister at the independent spent fuel storage installation pad. These exercises contained: (1) all vendor personnel trained and qualified under the new training program, (2) use of more personnel, located in strategic positions to observe canister downloading, (3) utilization of the enhanced procedures, (4) implementation of the new canister transfer monitoring equipment, and (5) enhanced oversight by licensee personnel qualified under a new oversight training program. The station was fully successful in downloading and retrieving the canister during the exercises and the corrective actions taken were determined by the inspectors to be adequate to restore compliance and prevent recurrence of the performance issues that led to the misalignment event. (Section 2.2.8)

- The NRC inspectors closed the violation for the licensee failure to ensure that redundant drop protection features were available during the August 3, 2018, misalignment event. The NRC thoroughly reviewed the licensee's completed and proposed corrective actions related to the misalignment event and concluded the corrective actions were adequate to restore compliance, address extent of condition, and prevent recurrence. (Section 2.2.9)

- The NRC inspectors performed independent measurements and verifications of the radiological conditions at the licensee's independent spent fuel storage installation. The inspectors measured various locations including background areas, public access areas, owner-controlled areas, and representative locations on both generally licensed independent spent fuel storage installation pads. Based on the number and age of canisters in service, the NRC did not identify any radiological concerns during the survey. Additionally, the NRC did not identify any measurements at the owner-controlled area boundary or in the public access areas to be above normal background measurements. (Section 2.2.10)

## REPORT DETAILS

### Summary of Plant Activities

The San Onofre Nuclear Generating Station (SONGS) independent spent fuel storage installation (ISFSI) consists of two ISFSI designs located adjacent to each other. The Transnuclear, Inc. (TN) nuclear horizontal modular storage (NUHOMS) ISFSI contains 51 loaded concrete advanced horizontal storage modules (AHSMs), which hold stainless steel dry shielded canisters (DSCs). Spent fuel from all three reactors are stored at the NUHOMS ISFSI in 50 of the storage modules.

Greater-than-Class-C (GTCC) waste from the Unit 1 reactor decommissioning project is stored in one module. There is a total of 63 AHSMs on the NUHOMS ISFSI pad. The 12 empty AHSMs will be available for storage of additional GTCC waste from Units 2 and 3. The 63 AHSMs currently on the pad are designed for the 24PT1-DSC (Unit 1 fuel) and 24PT4-DSC (Unit 2/3 fuel) canisters, which hold a maximum of 24 spent fuel assemblies. The 24PT1-DSCs are loaded and maintained under Amendment 0 of Certificate of Compliance (CoC) No. 72-1029 and the 24PT4-DSCs are loaded and maintained under Amendment 1 of CoC No. 72-1029. Both systems were being maintained under Final Safety Analysis Report (FSAR), Revision 5.

The Holtec UMAX ISFSI portion was designed to hold 75 multi-purpose canisters (MPCs). The MPC-37s contain 37 pressurized water reactor fuel assemblies in accordance with UMAX CoC No. 72-1040, Amendment 2, the HI-STORM UMAX FSAR, Revision 4, and the HI-STORM FW FSAR, Revision 5. The licensee has 29 loaded canisters in service at the UMAX ISFSI. A 30$^{th}$ canister had been loaded, welded, dried, and helium backfilled, but remained inside the Unit 3 spent fuel building. The licensee ceased all loading operations to address the investigation and implementation of corrective actions associated with the August 3, 2018, misalignment incident.

## 1 Followup on Traditional Enforcement Actions (Inspection Procedure 92702)

### 1.1 Inspection Scope

The NRC performed this supplemental inspection in accordance with Inspection Procedure 92702, "Follow-up of Traditional Enforcement Actions Including Violations, Deviations, Confirmatory Action Letters, Confirmatory Orders, and Alternative Dispute Resolution Confirmatory Orders," to assess the licensee's response to the issues identified during the inspection documented in NRC Special Inspection Report dated, December 19, 2018, "Special Inspection Report 050-00206/2018-005, 050-00361/2018-005, 050-00362/2018-005, and 072-00041/2018-001 and Notice of Violation," (NRC Special Inspection) (ADAMS Accession ML18341A172), using the following inspection objectives:

- Objective 1: To assure that the root and contributing causes of significant performance issues were understood;
- Objective 2: To independently assess and assure that the extent of condition and extent of cause of significant performance issues were identified;

- Objective 3: To assure that corrective actions taken to address and preclude repetition of significant performance issues were prompt and effective;
- Objective 4: To assure that corrective action plans directed prompt actions to effectively address and preclude repetition of significant performance issues.

The NRC Special Inspection Report documented the NRC's review of an August 3, 2018, misalignment incident that occurred when a loaded spent fuel canister came to rest on the shield ring near the top of the UMAX ISFSI vault, which prevented it from being fully lowered into the storage vault. At that time, the important-to-safety (ITS) rigging and lifting slings were slack and were no longer capable of performing their safety function of supporting and controlling the loaded canister. This failure to maintain redundant drop protection placed the canister (No. 29) in an unanalyzed condition because the ISFSI FSAR assumed a postulated drop was a non-credible event. The estimated time the canister was in an unsupported position was approximately 45 minutes.

Following the misalignment incident, the licensee failed to notify the NRC that ITS equipment was disabled and would fail to function as designed when required by the Certificate of Compliance to provide redundant drop protection features to prevent and mitigate the consequences of a drop accident and no redundant equipment was available and operable to perform the required safety function. The licensee's failure to make the required report to the NRC existed for 39 days until the report was submitted and compliance restored.

On March 25, 2019, the NRC issued letter, "Notice of Violation and Proposed Imposition of Civil Penalty - $116,000 and NRC Inspection Report 050-00206/2018-005, 050-00361/2018-005, 050-00362/2018-005, 072-00041/2018-001," (ADAMS Accession ML19080A208), to document the final significance determination for the identified escalated violations. The licensee's failure to ensure ITS equipment was available to provide redundant drop protection during downloading operations was characterized as a finding having significant safety consequence and was identified as a Severity Level II violation of NRC requirements. The licensee's failure to make a timely notification to the NRC Headquarters Operations Center for the August 3, 2018, disabling of ITS equipment impacted the ability of the NRC to perform its regulatory oversight function and was identified as a Severity Level III violation of NRC requirements.

The inspectors reviewed the licensee's causal evaluations and supplemental information during the inspection period. The inspectors held discussions with licensee personnel to determine if the root causes, contributing causes, and the contribution of safety culture components related to the issues were understood, and that corrective actions taken or planned were appropriate to address the causes and preclude repetition.

## 1.2 Observations and Findings

### 1.2.1 Problem Identification and Cause Evaluations (Objective 1)

#### a. Overview

The inspectors verified that the licensee's evaluations adequately documented identification of the issues. The violation involving failure to provide redundant drop protection features during downloading operations was self-revealed and the violation for

failure to make a report to the NRC was NRC identified. The inspectors determined that the evaluations documented how long the issues existed and prior opportunities for identification. The inspectors also determined that the evaluation documented significant plant-specific consequences and compliance concerns associated with the issues.

The inspectors evaluated whether the licensee's causal evaluations were conducted to a level of detail commensurate with the significance of the problem, and whether the licensee's evaluations included consideration of prior occurrences of the problem and knowledge of prior operating experience.

b. Assessment

The licensee performed four causal evaluations to address the issues resulting from the August 3, 2018, misalignment incident. The four causal evaluations were tracked in the licensee's Corrective Action Program (CAP) and addressed the following areas:

- Root Cause Evaluation (RCE) Quality Investigation (QI)-2529 was initiated to identify the root causes and corrective actions necessary to address the misalignment event and enhance Holtec's processes and procedures to prevent recurrence.

- Apparent Cause Evaluation (ACE) (Action Report (AR) 0818-20356) was initiated to determine why the Southern California Edison Company (SCE) oversight was ineffective in preventing the misalignment event.

- Common Cause Evaluation (CCE) (AR 0618-77146) was initiated to identify common issues that challenged construction of ISFSI facilities and fuel transfer operations.

- Reportability Root-Cause Evaluation (RRCE) (AR 1218-33805) was initiated to determine why a report was not submitted to the NRC within the required time-frame.

The RCE QI-2529 identified one root cause and five contributing causes. Specifically, the evaluation determined that the root cause of this event was: *"Holtec Management failed to recognize the complexity and risks associated with fuel transfer operation while using a relatively new system design (UMAX) in conjunction with a long duration campaign, and thus, did not implement necessary program improvements or the necessary level of oversight."* The licensee determined that the contributing causes were: (1) inadequate content in procedures to recognize special conditions related to a new equipment system (UMAX); (2) the design review process did not ensure that unintended consequences of design features were captured; (3) communication protocols with a chain of command established during canister movements were not well defined; (4) Holtec had not established a continuous learning environment which promoted the use of internal and external operating experience; (5) the Holtec Training Program did not consider the uniqueness of the UMAX system relative to the other HI-STORM systems nor the uniqueness of challenges raised in a long-term project, which led to not fully establishing qualification or proficiency requirements for the task performers.

As a result, Holtec identified and addressed a significant number of weaknesses in the areas of design review, procedures, training, safety culture, operating experience,

corrective action processes, and communications. The SCE reviewed and approved Holtec RCE QI-2529 and the associated corrective actions through the SONGS's Corrective Action Program (CAP) as Action Request (AR) 0818-76588.

The ACE 0818-20356 identified one apparent cause and two contributing causes. Specifically, the evaluation determined that the apparent cause was: *"SCE ISFSI Project Management failed to establish a rigorous process to ensure technically accurate Holtec Procedures, adequate SCE and Holtec training to support procedure implementation, and sufficiently detailed Oversight Specialist guidance."* The licensee determined that the contributing causes were: (1) SCE project management observations were not being routinely performed, and (2) SCE project management had not consistently reinforced initiation of an AR for deviations from what was expected, even if covered by procedure, or that result in additional dose. As a result, the licensee identified and addressed a significant number of weaknesses in the areas of vendor material reviews, training for oversight individuals, oversight processes, safety culture, operating experience, and corrective action processes.

The CCE 0618-77146 identified one common cause and one contributing cause. Specifically, the licensee's evaluation determined that the common cause was: *"Holtec did not staff the project with knowledgeable experienced personnel to effectively manage, and administer, the Holtec Quality Assurance Program or the Holtec Corrective Action Program."* The licensee determined that the contributing cause was: (1) Holtec procedures and processes that feed into the Holtec CAP, were not sufficiently detailed or prescriptive to guide or instruct a person with limited quality and CAP experience to identify and effectively resolve conditions adverse to quality and/or trends in a timely manner. As a result, the licensee identified and addressed weaknesses in the areas of CAP processes and CAP training in both the Holtec and SCE CAP programs.

The RRCE 1218-33805 identified one root cause and two contributing causes. Specifically, the licensee's evaluation determined that the root cause was: *"SCE Management failed to recognize the transition to fuel transfer operations as requiring the integration, familiarization, and application of 10 CFR 72.75 reporting requirements into plant processes."* The licensee determined that the contributing causes were: (1) There was a lack of guidance to facilitate understanding of the wording in 10 CFR 72.75(d); and (2) SCE management did not encourage, and the organization did not demonstrate, a conservative bias for reporting. As a result, the licensee identified and addressed weaknesses in the areas of reportability training and the reportability process.

c. Observations

An observation was identified by the NRC inspectors during the review of the four causal evaluations, which related to contributing causes. The inspectors identified that the licensee failed to address one potential contributing cause of the spent fuel storage canister downloading event. Specifically, the inspectors noted that the site emphasis on minimizing radiation dose directly led to personnel critical to the oversight of the downloading evolution being relocated to a low dose area where direct observation of the downloading activities was not possible. This led to a partial loss of command and control of the evolution and was likely a contributing cause of the event.

The inspectors noted that this potential causal factor was identified in the ACE 0818-20356. However, the causal factor was not identified as a contributing factor

nor tracked as a specific corrective action in the ACE 0818-20356 or RCE QI-2529. The inspectors identified through interviews with the loading personnel that training on this causal factor was conducted for personnel involved in future downloading operations. However, the inspectors were unable to verify the subject was captured in the licensee's training lessons and training presentations. In response, the licensee initiated corrective action AR 0219-25489 to address the NRC identified issue. Corrective actions taken included revising the radiation protection work plan and training lesson plans to include radiation protection lessons learned. Corrective actions taken were adequate to resolve the NRC observation.

d. Conclusions

The inspectors independently reviewed the licensee's causal evaluations for the performance issues and significant findings that existed which led to the misalignment incident. The NRC concluded that the evaluations were conducted to a level of detail commensurate with the significance of the problems and the root causes combined with the contributing causes and adequately addressed the findings presented in the NRC Special Inspection Report. The inspectors also concluded that the root and contributing causes of the significant performance issues were understood by the licensee. One observation was identified by the NRC related to the identified contributing causes, which was subsequently entered into the CAP and addressed by the licensee to resolve the NRC concern. As a result, Inspection Objective 1 was met.

1.2.2 Extent of Condition and Extent of Cause Evaluation (Objective 2)

a. Overview

The inspectors verified that the significant performance issues were evaluated using a systematic methodology. The inspectors evaluated whether the root-cause evaluation was conducted to a level of detail commensurate with the significance of the problems, and that it included a consideration of prior occurrences of the problems and knowledge of prior operating experience. Additionally, the inspectors assessed whether the causal evaluations addressed the extent of condition and extent of cause associated with the significant performance issues and assessed whether the licensee appropriately considered safety culture traits.

b. Assessment

The inspectors determined that the licensee's causal evaluations used systematic methodologies and were conducted to a level of detail commensurate with the significance of the problems. The identified causes, discussed in the previous section, are the results of an aggregate review using multiple analytical techniques. The inspectors also determined that the causal evaluations included a consideration of prior occurrences of the problems and knowledge of prior operating experience.

The licensee used the following systematic methods to complete the four causal evaluations:

- The RCE QI-2529 applied: 1.) Five Whys Approach; 2.) Barrier Analysis; 3.) Organizational and Programmatic Assessment; 4.) Human Factor Analysis; 5.) Comparative Time Line; and 6.) Safety Culture Assessment

- The ACE 0818-20356 applied: 1.) Cause and Effect Charting; and 2.) Lines of Inquiry List

- The CCE 0618-77146 applied: 1.) Pareto Chart; and 2.) Bin Assessment

- The RRCE 1218-33805 applied: 1.) Cause and Effect Charting; 2.) Barrier Analysis; and 3.) Safety Culture Assessment

The inspectors determined whether the licensee's causal evaluations addressed extent of condition and extent of cause of the problems identified in the reviews. Specifically, the RCE QI-2529 assessed the degree that the actual condition may exist in plant equipment, processes, or human performance that could result in the same or similar consequences. The extent of cause-initiated changes within Holtec's processes, which included evaluation of other facility's downloading procedures, verification of crew composition, qualifications, lessons learned, training enhancements, and design reviews.

The licensee's ACE 0818-20356 assessed all other fuel movements and heavy lifts at SONGS. The extent of cause review-initiated changes in all other ISFSI loading procedures and reviews of ISFSI non-loading procedures. Additionally, changes were initiated in licensee oversight of other vendor activities, including decommissioning activities, in the areas of training, document reviews, oversight observation programs, and lessons learned.

The licensee's RRCE 1218-33805 assessed additional areas where reportability may have been required but was not made to the NRC. Through that review the licensee determined one notification to the NRC was required. This notification related to the lateral clearance between the low-profile transporter and other structures (e.g. light posts), and the low-profile transporter's center of gravity was not maintained in accordance with the seismically analyzed limits. The licensee made the required notification to the NRC under 10 CFR 72.75(d)(1) on December 20, 2018 (Event Notification (EN) 53798) (see Section 2.2.2 for further discussion of the licensee event report). The extent of cause review addressed other reporting requirements within 10 CFR 72.75 and other applicable federal regulations. Additional actions were taken to enhance training and procedural processes to ensure reporting requirements would be followed as required in 10 CFR Parts 20, 49, 50, 71, and 72.

c. Observations

An observation was identified by the inspectors during the extent of condition review for the four causal evaluations. The inspectors identified that the licensee failed to perform one of the extent of condition reviews described in ACE 0818-20356. Specifically, Corrective Action (CA) 17 (CA-17), which stated, for Holtec procedures, other than operating procedures, determine which ones have a potential impact on operations and conduct a review using the review guidance in Corrective Action to Prevent Recurrence 2 (CAPR-2). The CAPR-2 task actions were to include additional requirements in procedure S0123-XV-93, "Contractor Oversight," to ensure a more rigorous review was completed by SCE oversight staff before accepting the document for use at the station.

The NRC inspectors identified that this review of Holtec non-loading/maintenance procedures had not been performed as specified in CA-17. In response, the licensee initiated corrective action AR 0818-20356 to perform the required review. The review included approximately 15 Holtec procedures which involved areas of crane maintenance, special lifting device maintenance, vertical cask transporter (VCT) maintenance, foreign material control program, weld examination program, etc. The inspectors reviewed the comments and discrepancies that were identified by the SCE staff from the review. The documentation of the review included a table of all comments identified by SCE staff and the revised procedures that documented that identified issues were changed. The corrective actions taken were adequate to address the NRC observation.

d. Conclusions

The inspectors determined that the licensee evaluated the issues using systematic methodologies to identify root and contributing causes. Additionally, the inspectors concluded that the licensee's causal evaluations addressed the extent of condition and extent of cause of the issues and appropriately considered safety culture traits. One observation was identified by the inspectors which was related to the extent of condition review. The licensee addressed the issue by taking adequate corrective actions. As a result, Objective 2 was met.

1.2.3 Corrective Actions Taken (Objective 3)

a. Overview

The inspectors reviewed the licensee's causal evaluations to assess whether appropriate corrective actions were specified for the root and contributing causes or that the licensee had an adequate evaluation for why no corrective actions were necessary. The inspectors also assessed whether the corrective actions had been prioritized with consideration of the safety significance and regulatory compliance. The inspectors evaluated whether the corrective actions taken to address and preclude repetition of significant performance issues were prompt and effective, and whether the violations, related to the NRC Special Inspection, had been adequately addressed.

b. Assessment

The corrective actions taken by the licensee are described below in the following areas: (1) Licensee Oversight; (2) Procedures; (3) Training; (4) Equipment and Personnel; (5) Corrective Action Program; and (6) Reportability.

(1) Licensee Oversight

The licensee's ACE 0818-20356, contained the majority of the corrective actions for the area of licensee oversight. Corrective actions drove extensive changes to the training and qualification program that an ISFSI oversight specialist is required to complete. The licensee increased the number of oversight specialists that directly observe ISFSI operations from approximately 10 to 14 individuals. All existing and new specialists were required to complete the enhanced qualification program requirements. The licensee assigned a specific training manager to oversee the enhanced training/qualification program. The licensee developed new lesson plans as

part of the qualification process. The new lesson plans included training on new load monitoring equipment, new task specific guides for field observations, new oversight roles and responsibilities, expectations, procedure changes, use of the corrective action program, acceptance review process changes, lessons learned, and other topics.

The licensee developed procedure G-XV93-PTP-01, "Pool to Pad Job Guide Desktop Guide," Revision 0. The inspectors reviewed the procedure and observed that it contained job guides for the ISFSI oversight specialists to use as a tool to assist in preparation and observational direction on the critical tasks during fuel transfer operations. The procedure described key elements of all work activities, detailing how and why tasks were critical. The guide directed the ISFSI oversight specialists to which specific tasks were required to be observed. The inspectors' review concluded that the task guide contained all critical tasks associated with fuel operations.

The licensee's site acceptance process of vendor procedures and training documents were revised. The changes included additional requirements to ensure a rigorous review prior to procedure acceptance and use at SONGS. The inspectors reviewed the procedure changes and the package of reviews conducted by oversight personnel to ensure all new and previously accepted documents received the same level of review. The inspectors concluded that the changes were appropriate, the reviews were thorough, and all identified issues were adequately addressed and corrected.

The licensee's changes included developing an oversight management organization to conduct observations on oversight specialists while they performed their field duties. The program included peer-to-peer observational requirements by decommissioning oversight personnel, as well as management observational requirements of the ISFSI oversight personnel. The program also contained effectiveness review requirements to ensure the required peer and management observations were effective and completed as required. The inspectors reviewed audit packages that were performed on oversight specialists during training exercises. The peer and management observations were well documented, and all identified enhancements and coaching items were captured in the licensee's CAP. The NRC concluded that the licensee had made substantial improvements throughout the ISFSI oversight program. No NRC observations were identified in this area.

(2) Canister Handling Procedures

The licensee's ACE 0818-20356 and RCE QI-2529 evaluations of the misalignment incident identified corrective actions which were intended to address procedural inadequacies that contributed to the incident. To address identified issues, the causal evaluations recommended corrective actions for the procedures that included the following changes: (1) continuous monitoring of weight sensing equipment during downloading operations; (2) establishment of clear underload criteria for when to halt downloading operations; (3) defining crew member roles and responsibilities by title; (4) listing qualification requirements for the specified roles; (5) listing critical steps in procedures; (6) defining responsibilities of cask loading supervisors; and (7) identifying areas where escalated management oversight was required.

Changes (1) and (2) were specifically directed at Holtec Procedure HPP-2464-400, "MPC Transfer at SONGS," Revision 17. The NRC inspectors reviewed the procedure revisions that included the new requirement to continuously monitor the canister

weight. The procedure revisions included establishment of clear underload criteria for when to halt downloading operations. The revised procedure directed the VCT operator and VCT platform rigger to maintain visual contact with the VCT control panel screen, load shackle tablet weight display screen, and downloader slings during canister downloading operations.

Procedure HPP-2464-400, Section 7.6, "Canister Download into Cavity Enclosure Container (CEC)," was revised to include steps to record the canister weight and to establish an underload restriction value. These changes included contingency steps for re-centering the canister if downloading operators noted a restriction in downward travel. The procedure also directed stop work requirements if certain underload conditions were experienced. Those actions included withdrawing the canister back into the transfer cask, making the appropriate notifications to site management, and condition report initiation into the CAP.

Changes (3) through (7) were applied to all operational procedures related to dry cask storage operations at SONGS. Those procedures included HPP-2464-100, "MPC Pre-Operation Inspection;" HPP-2464-200, "MPC Loading at SONGS;" HPP-2464-300, "MPC Sealing;" HPP-2464-400, "MPC Transfer at SONGS;" HPP-2464-500, "MPC Unloading;" and HPP-2464-600, "Responding to Abnormal Conditions." The NRC inspectors verified that each of those procedures were updated with the new requirements.

(Closed) Notice of Violation VIO 07200041/2018-001-04, Failure to provide adequate instructions in procedures, 10 CFR 72.150, EA-18-155

The NRC Special Inspection Report documented a violation of NRC requirements related to the licensee's failure to prescribe activities affecting quality by documented instructions or procedures of a type appropriate to the circumstances and include appropriate quantitative or qualitative acceptance criteria for determining that important activities had been satisfactorily accomplished.

The licensee responded to the Notice of Violation and described the corrective steps taken to ensure full compliance in SCE submittal to the NRC, dated December 26, 2018 (ADAMS Accession ML18362A148). The inspectors reviewed the licensee's implemented corrective actions related to procedural direction during follow-up inspection activities. The inspectors concluded, based on the changes described above, that the licensee had performed adequate corrective actions to restore compliance, address extent of condition, and prevent recurrence.

However, the inspectors made observations related to the corrective actions to improve Holtec Procedure HPP-2464-400 (see Section 1.2.3.c.(2)). The licensee subsequently addressed the NRC observations. No additional deficiencies were identified during NRC's review of this violation.

This closes VIO 07200041/2018-001-04, "Failure to provide adequate instructions in procedures" (10 CFR 72.150), EA-18-155.

(3) Training

Inadequate training was identified by the licensee as a contributing cause that led to the canister misalignment event. Specifically, RCE QI-2529 Contributing Cause 5

stated, in part, that the "Holtec training program did not consider uniqueness of UMAX system relative to HI-STORM or uniqueness of challenges raised in a long-term project which led to not fully establishing qualification or proficiency requirements for the Task Performers when transferring a canister into a UMAX system."

The licensee had several corrective actions associated with training, for both fuel handling personnel and oversight personnel, which broadly included: updated initial training, on-the-job demonstrations, updated qualifications, ongoing proficiency requirements, updated training lesson plans, scripted pre-job briefs, and the incorporation of site-specific operating experience into the training program. The specific corrective actions associated with training included:

- CA-19 and CA-20: Developed a SONGS site-specific training program and procedures which augmented the existing Holtec corporate training program and procedures. The corrective actions required that the site training program to include a site-specific task list and a task to training matrix which described all the applicable positions of a fuel handling crew to be utilized at SONGS. The corrective actions required all positions to be described and minimum training and qualifications for each position listed. The training program was required to include the appropriate elements of a systematic approach to training (SAT).

- CA-22: Included a 10 CFR 72.48 evaluation to incorporate additional text into Chapter 9 of the FSAR to add criteria for load limits, training, procedure compliance, and use of engineering features.

- CA-23: Required the addition of a training consultant to perform an evaluation of the current site-specific training program, including effectiveness, and to provide recommendations for improvements to the Holtec standard training program. Areas of evaluation included, but were not limited to, review and enhancement of task analysis matrices, the development of training programs, implementation plans, proficiency requirements, and requalification requirements.

- CA-24: Required training and qualification for all loading personnel currently assigned to the project in accordance with new SONGS site-specific training program requirements (CA-20).

The licensee concluded that procedure HSP-34, "Training of Subcontracted Field Service Personnel," which was previously used to train and qualify the pool-to-pad personnel, was not based on a SAT. A site-specific training program, HPP-2464-1134, "Training of site services personnel," Revision 1, was developed by the licensee and reviewed by the inspectors. This SAT based program was developed to be used in conjunction with procedure HSP-34.

A SAT program is defined in 10 CFR 55.4, and includes the following attributes: (1) systematic analysis of job performance requirements and training needs; (2) the derivation of learning objectives, based upon the preceding analysis, which describe desired performance after training; (3) the training program design and implementation based on the learning objectives; (4) the evaluation of trainee mastery of learning objectives during training; and (5) the training program evaluation and revision based upon the performance of trained personnel in the job setting.

The new site-specific training procedure HPP-2464-1164 required:

- All positions to be described and minimum training and qualifications for each position listed in a training matrix.
- To contain the minimum qualification requirements to ensure that personnel were appropriately trained prior to performing fuel transfer activities.
- To include the appropriate elements of a SAT program.

The training corrective actions required the licensee to update all lesson plans, which included an additional 13 new lesson plans and development of seven new on-the-job training requirements using the SAT process. The corrective action program and Operating Experience (OE) programs were included as a feedback loop into the training program as required by procedure HPP-2464-1164. In addition, the licensee staffed a site program training manager to oversee the training program and ensure the SAT program elements were maintained. Finally, the inspectors reviewed the changes in UMAX FSAR, Chapter 9, to verify the change included revised language from CA-22.

(Closed) Notice of Violation VIO 07200041/2018-001-03, Failure to assure that operations of important-to-safety equipment were limited to trained and certified personnel, 10 CFR 72.190, EA-18-155

The NRC Special Inspection documented a violation of NRC requirements related to the licensee's failure to assure that operation of equipment and controls, that had been identified as ITS in the Safety Analysis Report, were limited to trained and certified personnel or were under the direct supervision of an individual with training and certification in the operation.

The licensee submitted a response to the NRC on December 26, 2018 (ADAMS Accession ML18362A148), which contained the corrective steps taken to ensure full compliance was achieved. The inspectors reviewed the licensee's implemented corrective actions related to the training of personnel during follow-up inspection activities. The inspectors concluded, based on the changes described above, that the licensee had performed adequate corrective actions to restore compliance, address the extent of condition, and prevent recurrence. No additional deficiencies were identified during the inspectors' review of this violation.

This closes VIO 072-00041/2018-001-03, "Failure to assure that operations of important-to-safety equipment were limited to trained and certified personnel" (10 CFR 72.190), EA-18-155.

(4) Equipment and Personnel

The licensee's causal evaluation contained corrective actions to implement a new load monitoring system, increased the number personnel present during downloading operations, and added remote monitoring capabilities to limit canister misalignments and prevent a condition in which the lifting devices no longer controlled the weight of the canister.

The new load monitoring equipment included two load sensing shackles, which were placed in-line with each respective downloading sling. These dual and redundant load sensing shackles were calibrated by an approved vendor to an accuracy of ±1% of the actual weight. The load sensing shackles wirelessly transmitted the weight of the canister to two digital readout tablets. Each tablet was equipped with an audible and visual alarm that would activate when the weight decreased below the established set points. One tablet was positioned next to the Holtec cask loading supervisor and SCE oversight specialist. The second tablet was positioned above the VCT control box and could be observed by both the VCT operator and an additional spotter, who was required to be on the VCT platform during downloading operations.

As part of the equipment enhancements, the licensee installed a camera on the side of one of the VCT towers. The camera was positioned to provide an overhead view of the top of the canister as it passed through the transfer cask into the ISFSI vault. The camera wirelessly displayed the video feed to a monitor that was located next to the Holtec cask loading supervisor and the SCE oversight specialist.

Other enhancements included increased number of personnel on the ISFSI pad during downloading operations from the two personnel (VCT operator and rigger in the man-basket) during the August 3rd incident to nine individuals on the ISFSI pad. This included an additional rigger in a separate elevated lift-basket to visually observe the canister as it was lowered through the transfer cask into the ISFSI vault.

During the downloading demonstrations performed by the licensee January 28 through February 1, 2019, the NRC inspectors observed the licensee successfully utilize the new equipment to safely lower a canister into the ISFSI vault. However, the inspectors identified two violations of NRC requirements regarding the licensee's equipment implementation and procurement of the new load monitoring equipment (see Section 1.2.3.c.(3) and (4)).

(5) Corrective Action Program

The licensee's ACE 0818-20356, RCE QI-2529, and CCE 0618-77146 identified corrective actions to address deficiencies in the CAP. The ACE 0818-20356 identified that ISFSI project management had not encouraged initiation of condition reports for deviations experienced in dry cask storage operations as a contributing cause. The RCE QI-2529 identified that Holtec had not fostered an environment that promoted sharing of internal and external operating experiences among the dry cask storage workers. The CCE 0618-77146 identified Holtec procedures and processes that input to the Holtec Field Condition Report (FCR) process and the Holtec CAP, were not sufficiently detailed or prescriptive to guide or instruct a person with limited quality assurance (QA) and CAP experience to identify, and effectively resolve, conditions adverse to quality and/or trends in a timely manner.

To address these issues, all three of these causal evaluations recommended corrective actions in the area of the CAP which included the following actions: (1) conducting a lessons learned case study based on recent events to clarify condition report initiation; (2) developing oversight specialist condition report training; (3) revising procedure HSP-42, "Project Manager's Desktop guide for Site Services Pool to Pad Projects," to include a section on operational experience; (4) revising procedure HSP-35, "Procedure for Field Condition Reports and Procedure Field

Change Notices for All Site Work," to provide clarification on the threshold for condition report initiation; (5) establishing a process to ensure operational experiences were communicated across and within project areas; (6) assigning a qualified and experienced full time Holtec QA Manger to the ISFSI Project to oversee the CAP; (7) developing a SCE CAP training plan; and (8) requiring Holtec to adopt and adhere to SCE's CAP for SONGS related work activities.

Action (1) required SCE to develop a personnel training module that included specific events identified during active fuel transfer operations that provided lessons learned applicable to improving SCE's implementation of its CAP. The training developed by SCE included examples of deviations experienced during the loading campaign and at other sites as well as the August 3, 2018, downloading operations. The inspectors reviewed the training documentation and verified that applicable dry cask storage staff had completed the required training.

Action (2) involved training the SCE oversight specialists in documenting issues into the oversight specialist database. The training emphasized the documentation of relevant issues or comments into the database with sufficient detail such that the observed deficiencies could be understood. The inspectors reviewed the training documentation and verified the roster of ISFSI oversight specialists had completed the required training.

Action (3) revised procedure HSP-42 to include steps which required operating experience, lessons learned, and best practices encountered during the execution phases of fuel loading operations to be captured by the Holtec project manager. Six sources of operating experience were identified: (1) standard shift turnover sheets; (2) FCRs; (3) management observation program comments; (4) site services weekly project updates/conference calls; (5) the Holtec Users Group database; and (6) the Holtec Lessons Learned database. The operating experience collected from these sources was required to be shared with dry cask storage workers during pre-job briefings and two-minute drills, as applicable, by the Holtec site project manager.

Action (4) revised procedure HSP-35 to provide procedural clarification on the threshold for initiating an FCR. The definitions section of procedure HSP-35 was expanded to include "Short-term Operations." A procedure step was included that explained that "any observed event during Short-term Operations that indicated an abnormal or unexpected condition shall be entered into the FCR tool for further evaluation."

Action (5) revised procedure HSP-42 to require the project manager to collect and disseminate pertinent operating experience to the appropriate dry cask storage personnel on a routine basis. This corrective action also relied on changes made to procedure HSP-35, which lowered the threshold for FCR reporting; SCE CAP training, which redefined the lower thresholds for problem identification; and procedure HSP-1101, "Procedure for Project Risk Management," which was revised to include lessons learned and operating experience documentation that must be reviewed for potential risk impacts.

Action (6) appointed a QA manager for Holtec to the SONGS facility. The appointee had experience with 10 CFR Part 50, Appendix B, and 10 CFR Part 72, Subpart G, requirements. The quality manager tasks included actions to improve quality in work

performed at SONGS, interface with Holtec personnel, maintaining high standards for Holtec work activities, performing corrective action evaluations, performing trending on FCRs, and addressing quality related issues as they are identified on site. The NRC inspectors reviewed the new quality assurance manager's resume and confirmed the individual had the knowledge and experience to perform the required responsibilities.

Action (7) required CAP training to be provided to site personnel. The NRC reviewed lesson plans and attendance records. The training lesson plans contained all the required information described in the causal evaluation and included additional enhancements to strengthen the CAP.

Action (8) required all workers, including contractors, to use the SCE CAP for activities on site. The NRC reviewed the revised process, which included an organization chart to identify which onsite personnel would have access to SCE's Action Request system and documentation that showed Holtec managers and workers had been provided credentials to access the Action Request system.

(Closed) Notice of Violation VIO 07200041/2018-001-01, Failure to identify and correct conditions adverse to quality (10 CFR 72.172), EA-18-155

The NRC Special Inspection documented a violation of NRC requirements related to the licensee's failure to establish measures to ensure that conditions adverse to quality, such as failures, malfunctions, deficiencies, and deviations were promptly identified and corrected.

The licensee submitted a response to the NRC on December 26, 2018 (ADAMS Accession ML18362A148) which contained the corrective actions taken to ensure full compliance was achieved. The inspectors reviewed the corrective actions implemented related to the use of the licensee's corrective action program during follow-up inspection activities. The inspectors concluded, based on the changes described above, that the licensee had performed adequate corrective actions to restore compliance, address the extent of condition, and prevent recurrence. No additional deficiencies were identified during the inspectors' review of this violation.

This closes VIO 07200041/2018-00101, "Failure to identify and correct conditions adverse to quality" (10 CFR 72.172), EA-18-155.

(6) Reportability

The licensee performed a reportability root cause evaluation (RRCE 1218-33805) to evaluate their failure to make an event notification to the NRC Operations Center for the August 3, 2018, misalignment incident. The corrective actions to address the identified causes included the following actions: (1) developing 10 CFR 72.75 training that identified ITS components, potential accidents, and failures that influence reportability; (2) establishing requirements for biennial refresher training; (3) conducting reviews to determine potential reportability requirements related to other site activities; (4) conducting reviews to determine the target audience for training the reportability changes; (5) revising site notification procedures to have a more conservative reporting bias and the identification of the Shift Manager as the individual responsible for the final decision on reportability for the site; (6) developing and conducting a case study with licensee managers and regulatory assurance

personnel on the communications and reportability aspects of the August 3, 2018, incident; and (7) conducting all-hands briefings regarding the reportability violation and future expectations for reporting.

For actions (1) through (4), SCE developed 10 CFR 72.75 training and required biennial refresher training. This training was delivered to SCE managers and Regulatory Assurance personnel. The training included discussions of accidents and design basis events for both the UMAX and NUHOMS ISFSI designs. The training included the descriptions and function of ITS structures, systems, and components and potential failures that would require reporting under 10 CFR 72.75. The training and biennial refresher requirements were included under the Shift Manager/Certified Fuel Handler Training Program. The initial target audience was SCE managers and Regulatory Assurance staff.

Action (5) required that SCE revise procedure SO-123-0-A7, "Notification and Reporting of Significant Events," to have a conservative bias toward reporting requirements. The procedure was revised to include guidance that if the condition being considered did not literally meet the reporting criteria, but was close, then the staff was directed to make a voluntary report using the closest reporting requirement that matched the condition under consideration. This was required to be completed within the time-frame stipulated by the reporting requirement. Procedure SO-123-0-A7 was also revised to encourage the voluntary reporting of any event or condition that could have safety significance or represent a generic concern.

The reporting procedure was further revised to identify the Shift Manager as the site individual responsible for making the final decision on reportability. Lastly, the SCE notification procedure was revised to include Attachment 11, "Reportability Determination," for a decision-making flow-chart. The flow-chart required the Shift Manager to chair a Reportability Management meeting/conference call to discuss potential reporting conditions. The call decision was required to be documented with the date and time of the decision, the start-time of the reportability clock, when the report was due, and the date/time the event notification was made.

Action (6) required the licensee to develop a case study training module that covered the specifics of the August 3, 2018, misalignment incident and the contributing factors that led to the licensee's failure to properly assess the event and to report the incident to the NRC Operations Center, as required by 10 CFR 72.75(d)(1). The case study discussed the specific details of the incident, acknowledged missed opportunities, and provided examples of how the notification procedure was revised to prevent recurrence of the notification failure. The case study required attendees to fill out a work-sheet that asked specific questions related to the event.

Action (7) required that the Chief Nuclear Officer provide an all-hands briefing to SCE staff and a separate briefing to SCE managers to discuss the violation. The briefings were to discuss the licensee's failure to make the 24-hour NRC notification, the causes of the failure, and management expectations for a conservative bias when making reportability decisions moving forward.

(Closed) Notice of Violation VIO 072-00041/2018-001-05, "Failure to make 24-hour notification" (10 CFR 72.75), EA-18-155

The NRC Special Inspection documented a violation of NRC requirements related to the licensee's failure to make a required 24-hour notification to the NRC within the required timeframe.

On November 8, 2018, the licensee issued Licensee Event Report (LER) 2018-001-0 (ADAMS Accession ML18317A060) in accordance with 10 CFR 72.75(d)(1) for the event and restored compliance. The licensee submitted its response to the Notice of Violation, on April 23, 2019 ADAMS Accession ML19116A056), which contained the corrective actions taken to ensure full compliance was achieved.

The NRC concluded that SCE's completed and proposed corrective actions, as described above, restored compliance, addressed extent of condition, and were adequate to prevent recurrence. No additional deficiencies were identified during the inspectors' review of this violation.

This closes VIO 072-00041/2018-001-05, "Failure to make 24-hour notification," (10 CFR 72.75), EA-18-155.

c. Observations and Findings

(1) Executive Oversight Board

The inspectors observed that CAPR-1 associated with the RCE QI-2529 appeared to be administrative in nature and did not meet the level of rigor associated with a CAPR, which should serve to preclude repetition of significant performance issues. The CAPR assigned changes to the Executive Oversight Board agenda to provide an increased focus on early identification of challenges to the project to ensure issues were properly resolved before undesired events occurred.

In response to the inspectors' observation, the licensee placed the identified observation into the corrective action program as AR-0818-7655. The licensee bolstered the required changes to the Executive Oversight Board agenda to incorporate additional techniques to review Management Review Meeting data, participation to evaluate current performance against risk registers, evaluate industrial safety trends, review quality metrics, and review SCE oversight effectiveness. The changes provided rigor to the agenda which served to consistently evaluate project performance against pre-determined standards. The NRC inspectors reviewed the new meeting agenda to verify the topics reviewed would ensure early identification of challenges to the project. Based on the licensee's changes and level of detail that would be reviewed during the meetings, the NRC concluded that the changes were appropriate to support early identification of significant performance deficiencies.

(2) Downloading Procedure

The inspectors determined that SCE had made substantial improvements to fuel handling procedures to ensure safe operations. However, the NRC identified that notable procedural weaknesses remained in downloading procedure HPP-2464-400 "MPC Transfer at SONGS," Revision 17. Procedure weakness included: (1) missing contingency steps for potential new equipment failures; (2) while there were some

criteria specified for when to suspend downloading operations, not all scenarios were addressed; and (3) the procedure lacked some steps necessary to maintain seismic qualifications during cask transport from the fuel building to the spent fuel storage pad.

In response, the licensee initiated AR 0119-81239-10 and AR 0119-81239-9 to capture the inspectors' observations. The licensee took corrective actions and addressed the identified omissions in the next procedural revision.

(3) Equipment Designation

Corrective action CA-1, associated with ACE 0818-20356, implemented guidance for a load monitoring device to ensure load indication was available to assist with suspending operations if the load was lost. SCE implemented the design change to incorporate the new load monitoring equipment using Nuclear Engineering Change Package (NECP) 0918-64884, "VCT Live Load Monitoring System," Revision 1. The load monitoring equipment included intermediate slings, a master link, and load sensing shackles which would be placed in-line with each of the ITS downloading slings. The inspectors identified that the NECP inappropriately designated the new load monitoring equipment as not-important-to-safety (NITS). Inspectors determined that since the new equipment was to be placed in-line with existing ITS downloading equipment, the new equipment, which failure could result in the drop of a loaded canister, should be controlled and designated under SCE Quality Assurance Program as ITS equipment.

10 CFR 72.146(a) states, in part, the licensee shall establish measures to ensure that the design bases are correctly translated into specifications, drawings, procedures, and instructions. These measures must include provisions to ensure that appropriate quality standards are specified and included in design documents.

Contrary to the above, on December 7, 2018, the licensee failed to establish measures to ensure that the appropriate quality standards were specified and included in design documents. Specifically, the licensee inappropriately designated the new load monitoring equipment at the wrong quality standard in NECP 0918-64884-1, Revision 1.

This violation was dispositioned per the traditional enforcement process using Section 2.3 of the NRC's Enforcement Policy. The NRC determined that the finding was of low safety significance since the equipment had not been used with any loaded canisters and the load monitoring equipment had been purchased by the vendor at the appropriate quality assurance designation of ITS. This finding was determined to be of more than minor safety significance since if left uncorrected, the deficiency could lead to a more significant safety concern.

Consistent with the guidance in Section 1.2.6.D of the NRC Enforcement Manual, if a violation does not fit an example in the Enforcement Policy Violation Examples, it should be assigned a severity level: (1) commensurate with its safety significance; and (2) informed by similar violations addressed in the Violation Examples. The violation was evaluated to be similar to Enforcement Policy Section 6.5.d.2.

The licensee entered the issue into the CAP as AR 1218-20333. The licensee restored compliance by verifying that the load monitoring equipment met all applicable

industry standards of NUREG 0612 and American National Standards Institute (ANSI) N14.6 requirements to meet the ITS qualification and revised the design change package to include the correct designation. Additional corrective actions taken by the licensee to preclude repetition included: performing an event investigation, conducting training for the SCE engineering team, conducting reviews of implementing procedures, and updating the site's Quality Equipment List. Because the licensee entered the finding into the CAP, the safety significance of the issue was low, and the issue was not repetitive or willful, this Severity Level IV violation was treated as a non-cited violation (NCV), consistent with Section 2.3.2.a of the Enforcement Policy (NCV 07200044/2018-002-01, Failure to ensure appropriate quality standards (10 CFR 72.146)).

(4) Equipment Procurement

The NRC inspectors reviewed all the procurement documents associated with the new load monitoring equipment that was described in NECP 0918-64884-1. This included reviewing the Holtec purchase specifications and equipment's certificate of conformance for each of the new components (load sensing shackles, master links, and intermediate slings).

The weight of the loaded canister, rigging equipment, and an additional 15% dynamic factor was calculated to be 118,640 lbs (59.34 tons) per HI-2156458 "Cask Handling Weights at SONGS," Revision 1. Each side of the rigging was required to be able to handle the load in the event that one side fails. This would require all rigging on each side to have a minimum rating of 59.34 tons.

The inspectors identified an issue with the certificate of conformance for the StraightPoint load sensing shackles. The load sensing shackles were rated to the capacity of 185,000 (92.5) tons, which was well above the required rating. However, the Holtec Purchase Specification PS-223 "Procurement Specification for Significant Rigging," Revision 0, Step 7.0, "Special Tests," required a proof test load of twice the rated vertical capacity to all rigging components. This is also required by common industry rigging standards contained in American Society of Mechanical Engineers (AMSE) B30.26 "Rigging Hardware," Section 1.4.2. The inspectors identified that the load sensing shackles were only load tested to 1.5 times the rated capacity instead of the required twice the rated capacity per purchase specification PS-223.

Additionally, Holtec's Approved Vendor List, contained the following restriction, "lifting equipment load testing must be performed at Aston I&I Sling factory." The inspectors observed that the proof load testing for the new load sensing shackles was performed at the manufacturer's facility (StraightPoint) and not by Aston I&I Slings factory per Holtec's Approved Vendor List's restrictions.

10 CFR 72.154(a) states, in part, the licensee shall establish measures to ensure that purchased material, equipment, and services, whether purchased directly or through contractors and subcontractors, conform to the procurement documents.

Contrary to the above, on December 7, 2018, the licensee failed to establish measures to ensure that purchased equipment conformed to the procurement documents. Specifically, the licensee accepted the StraightPoint load sensing shackles, which had not been proof load tested to twice the rated capacity as specified in Holtec Purchase

Specification PS-223, Step 7.0. Additionally, the licensee failed to ensure the proof load testing was performed by an approved vendor.

This violation was dispositioned per the traditional enforcement process using Section 2.3 of the NRC's Enforcement Policy. The NRC determined that the finding was of low safety significance since the equipment had not been used with any loaded canisters. This finding was determined by inspectors to be of more than minor safety significance because, if left uncorrected, the deficiency could lead to a more significant safety concern.

Consistent with the guidance in Section 1.2.6.D of the NRC Enforcement Manual, if a violation does not fit an example in the Enforcement Policy Violation Examples, it should be assigned a severity level: (1) commensurate with its safety significance; and (2) informed by similar violations addressed in the Violation Examples. The violation was evaluated to be similar to Enforcement Policy Section 6.5.d.2.

The licensee entered the issue into the CAP as AR 1219-52380. The licensee restored compliance by having the load sensing shackles proof tested to twice the rated capacity in accordance with purchase specification PS-223, by the Aston I&I Slings factory per Holtec's Approved Vendor List's restrictions. Additional corrective actions taken by the licensee to preclude repetition included: performing an apparent cause evaluation, reviewing other procured equipment documentation from Aston I&I Slings to ensure testing requirements were met, developing a revised SONGS rigging program to require an independent review and approval of vendor ITS rigging documentation, creating a project specific purchase specification for downloading shackles to provide clear details on load testing requirements, and conducting training for SCE site service project managers. Because the licensee entered the finding into the CAP, the safety significance of the issue was low, and the issue was not repetitive or willful, this Severity Level IV violation was treated as a NCV, consistent with Section 2.3.2.a of the Enforcement Policy (NCV 07200044/2018-002-02, Failure to ensure purchased material conformed to the procurement documents (10 CFR 72.154)).

d. Conclusions

Based on the licensee's evaluations and actions taken in the areas of licensee oversight, procedures, training, equipment, corrective action program, and reportability, the inspectors concluded that the corrective actions implemented were appropriate to prevent recurrence of the issues and were adequately prioritized with consideration of the risk significance and regulatory compliance. The inspectors concluded that SCE's completed corrective actions in the areas of training, corrective action program, and procedures restored compliance for the violations document in the NRC Notice of Violation issued in the NRC Special Inspection Report.

Additionally, the licensee's corrective actions taken to address the violation for failure to make a report to the NRC, documented in NRC letter of Notice of Violation and Civil Penalty, were adequate to restore compliance and prevent recurrence. However, during the NRC's review of the corrective actions taken, the inspectors identified two observations and two violations of NRC requirements related to the licensee's corrective actions. The licensee took adequate corrective action to restore compliance on the issues identified through the CAP. The violations were determined to have low safety

significance and the Severity Level IV violations were treated as NCVs. As a result, Inspection Objective 3 was met.

1.2.4. Corrective Actions Planned (Objective 4)

a. Overview

The inspectors evaluated whether the corrective actions planned to address and preclude repetition of significant performance issues were prompt and effective, and that appropriate quantitative or qualitative measures of success had been developed for determining the effectiveness of planned corrective actions.

b. Assessment

The licensee's causal evaluations contained effectiveness assessments to validate that the corrective actions were successful. In the area of training, the licensee's corrective action plan included acquiring a training consultant to perform an evaluation of the new site-specific training program, including effectiveness, and develop recommendations for improvement. The recommendations would support training enhancements for the SONGS training program and the vendor's standard training program. The area to be evaluated included task analysis matrices, training program, implementation plans, proficiency requirements, and requalification requirements.

In the area of operations, an effectiveness review schedule was established to assess the effectiveness of all corrective actions during both dry run demonstrations/training evolutions and during actual fuel movement activities. The review included an assessment of trends in lifting activities, verification of trained personnel, and detailed observational surveillance of lifting activities by independent auditors. The surveillance tasks included a review of training verification, procedure proficiency, adequate use of the CAP, and verification of management observations.

The licensee's oversight effectiveness review included corrective actions to conduct additional procedure reviews to identify new technical deficiencies, review of oversight task guides to verify sufficient guidance and enhancements, and various peer observations of oversight individuals to verify proficiency in procedures, task guide knowledge, initiation of corrective actions, and ensure desired behaviors. The effectiveness review actions contained detailed criteria that an independent assessor was required to verify during the dry-run exercises and during continued fuel loading activities.

In the area of reportability, the licensee's corrective actions included a new real time reporting exercise to be conducted monthly. All applicable individuals would be required to participate in the exercise. The exercises would take place for three consecutive months and success would be based on no incorrect reportability determinations. In addition, the new reportability process required the assignment of a "meeting skeptic" to monitor the reportability meetings to ensure the desired behavior changes continued and adequate determinations were made.

c. Observations and Findings

No findings were identified with the licensee's corrective actions planned.

d. Conclusion

Based on the licensee's evaluations and documented actions planned, the inspectors concluded that the licensee had adequately established measures to validate the effectiveness of the corrective actions to prevent recurrence. As a result, Inspection Objective 4 was met.

## 2 Follow-up of Events and Notices of Enforcement Discretion (IP 71153)

### 2.1 Inspection Scope

The inspectors evaluated licensee events to verify the licensee's corrective actions were adequate to restore compliance. The inspectors reviewed LERs to ensure the reports were timely, accurate, and the required corrective actions had been completed. Additionally, inspectors documented review of follow-up items from the NRC Special Inspection Report.

### 2.2 Assessment

#### 2.2.1 (Closed) Licensee Event Report 2018-001-0, Spent Nuclear Fuel Canister Temporarily Wedged in Dry Cask Storage Container

On November 8, 2018, the licensee issued LER 2018-001-0 (ADAMS Accession ML18317A060) in accordance with 10 CFR 72.75(d)(1) and (g) for inadvertently disabling redundant ITS slings while lowering a spent fuel canister into the ISFSI on August 3, 2018.

The NRC Special Inspection Report, dated December 19, 2018, documented three cited violations and two apparent violations associated with this event that were handled through the NRC's escalated enforcement process.

During this supplemental inspection, the NRC inspectors reviewed the planned and implemented corrective actions taken by the licensee for the identified violations and determined the actions to be adequate to restore compliance and prevent recurrence.

This LER is closed.

#### 2.2.2 (Discussed) Licensee Event Report 2018-002-0, Spent Nuclear Fuel Transport Conveyance Vehicle Operated Outside Obstacle Clearance Limits

On February 14, 2019, the licensee issued LER 2018-002-0 (ADAMS Accession ML19050A170) in accordance with 10 CFR 72.75(d)(1) and (g) for past operations of the low-profile-transporter. The licensee identified that transporter's center of gravity was not maintained within limitations specified in the site's specific analysis and operations had been conducted too close to adjacent structures (light posts) and was outside the calculated clearance limits specified in the site's seismic analysis. The licensee identified that the site procedures did not provide sufficient detail to comply with the seismic stability calculation. No actual incidents with structures or collisions with obstacles occurred during past fuel transfer operations and there was no impact to plant personnel or public health and safety.

As part of the licensee's extent of condition review associated with licensee causal evaluation RRCE 1218-33805, the licensee notified the NRC Operations Center within 24 hours of discovery of the issue (Event Notification 53798) and submitted an LER to the NRC within the 60-day time limit in accordance with 10 CFR 72.75(d)(1) requirements.

As part of the review of the August 3, 2018, event, the inspectors reviewed the licensee's corrective actions to restore compliance and prevent recurrence. This included reviewing the licensee's updated seismic analysis which determined that the variance in the height of the conveyance, during the past operations was acceptable and the licensee's changes made to the transportation procedures. Additionally, the inspectors observed licensee perform dry run exercises that demonstrated the procedural changes were adequate to ensure the conveyance would remained within the bounds and limitations of the analysis (see Section 2.2.8). However, as reported in the LER, the licensee was still in progress of developing an analysis to determine if the operation of the conveyance with the reduced obstacle clearance was acceptable. Thus, this LER will remain open, pending NRC review of this additional information.

2.2.3 (Closed) NRC Event Notification #53858, Inadequate Analysis for VCT Operations

During the on-site portion of this inspection, the NRC inspectors observed demonstrations of the licensee's corrective actions associated with downloading operations. As the VCT approached the mating device, the procedural steps directed the removal of the restraint band from around the HI-TRAC VW transfer cask. As operations continued, the transfer cask was raised and continued to travel approximately 15-20 feet before being lowered onto the mating device to allow downloading operations to begin. While traveling without the restraint band, the transfer cask was visibly rocking as the VCT approached the mating device. The inspectors questioned the licensee during the site observations to determine if the site's seismic analysis addressed and evaluated travel of the loaded HI-TRAC VW without the restraint band.

On February 2, 2019, in accordance with 10 CFR 72.75(d)(1) the licensee notified the NRC Operations Center within 24 hours of the discovery of issues regarding the past use of the VCT to transport spent fuel storage canisters to the ISFSI pad. The licensee reported that over short periods of time, the canister transport process utilizing the VCT could have been operated without a supporting seismic analysis while transporting loaded canisters for storage. The licensee subsequently retracted Event Notification #53858 on April 2, 2019, citing a revised seismic calculation which confirmed the transport process and VCT operations met the seismic requirements of the Holtec Certificate of Compliance.

The licensee's failure to follow the initial site specific seismic analysis was determined by inspectors to be a violation of NRC requirements. This event notification is closed (see Section 2.2.4 below).

2.2.4 Finding related to the Licensee's Event Notification

The licensee's event notification EN #53858 documented that past VCT operations had not been conducted within the requirements of seismic evaluation HI-2156626, "VCT Stability Analysis on Route to ISFSI Pad and on ISFSI Pad for SONGS," Revision 3. For short periods of time, the VCT seismic restraint band was prematurely removed from the

transfer cask prior to stack-up evolutions. Evaluation HI-2156626, Section 4.0, "Assumptions," stated that, "the transfer cask and the VCT were considered to behave as a rigid body." The evaluation conservatively assumed the seismic restraint band, which braced the transfer cask to the VCT, was in position at all times during transportation operations.

10 CFR 72.212(b)(3), requires, in part, that the general licensee shall ensure that each cask used conforms to the terms, conditions, and specifications of a Certificate of Compliance as listed in 10 CFR 72.214.

10 CFR 72.214 states, in part, that Certificate Number 1040 [Docket Number 072-01040] Amendment Number 2, effective date January 9, 2017, is an approved cask for storage of spent fuel under the conditions specified in the Certificate of Compliance for the Holtec HI-STORM UMAX Storage System.

Certificate of Compliance 072-01040, Appendix B Technical Specification 3.4.15 requires, in part, the loaded transfer cask and its conveyance shall be evaluated to ensure, under the site-specific Design Basis Earthquake (DBE), that the cask and its conveyance does not tip-over or slide off the haul route.

Contrary to the above, from January 30, 2018, to August 3, 2018, the licensee failed to ensure the cask and its conveyance was evaluated under the site-specific DBE. Specifically, the NRC identified that past VCT transportation operations were not evaluated under the site-specific DBE, since operations were conducted outside the requirements in seismic evaluation HI-2156626.

This violation was dispositioned per the traditional enforcement process using Section 2.3 of the NRC's Enforcement Policy. The NRC determined that the finding was of low safety significance since the licensee had re-performed the evaluation, addressed the deviation that occurred, and demonstrated the canister and its conveyance would not have tipped over or slipped off the haul route during those transportation operations due to prematurely removing the seismic restraint band. This finding was determined by inspectors to be of more than minor safety significance, since if left uncorrected, the deficiency could lead to a more significant safety concern.

Consistent with the guidance in Section 1.2.6.D of the NRC Enforcement Manual, if a violation does not fit an example in the Enforcement Policy Violation Examples, it should be assigned a severity level: (1) commensurate with its safety significance; and (2) informed by similar violations addressed in the Violation Examples. The violation was evaluated to be similar to Enforcement Policy Section 6.1.d.1.

The licensee entered the finding into the CAP as AR 0219-88442, 0219-22465, and 0319-95843. The licensee restored compliance by revising the site-specific seismic analyses to bound transportation operations conducted at the site. Additional corrective actions taken by the licensee to preclude repetition included: performance of an apparent cause evaluation, submittal of formal reports to the NRC in accordance with 10 CFR 72.75(d)(1), conducted training on the lessons learned, briefed the Holtec Users Group, and revised the process used to transmit vendor information to the NRC to require a documented review by the appropriate SONGS organization prior to transmittal. Because the licensee entered the issue into the CAP, the safety significance of the issue was low, and the issue was not repetitive or willful, this Severity Level IV

violation was treated as a NCV, consistent with Section 2.3.2.a of the Enforcement Policy (NCV 07200044/2018-002-03, Failure to ensure the loaded transfer cask and its conveyance was evaluated under the site-specific DBE (10 CFR 72.212)).

2.2.5 Follow-up of Special Inspection Charter Items from the NRC Special Inspection

a. Drop Evaluation

The inspectors independently reviewed licensee's evaluation to analyze the potential effects of a canister drop. The licensee evaluation was documented in evaluation HI-2188261 "Structural Evaluation of the MPC Handling Event at SONGS," Revision 3. Evaluation HI-2188261 conservatively assumed the canister fell, uninterrupted, 25 feet to the base of the UMAX vault. The actual height the canister potentially could have dropped was 18 feet. The evaluation defined a canister breach as the point at which the strain measured at any location exceeded the specified strain limit for the material.

Following the guidance from NUREG-1864 "A Pilot Probabilistic Risk Assessment of a Dry Cask Storage System at a Nuclear Power Plant," dated March 2007, the evaluation considered the effects of strain rate and temperature, using a strain in the weld material to be estimated at 0.73 in/in (extension length/original length). Conservatively, the evaluation used one standard deviation below the allowable strain to establish a limit of 0.55 in/in for the weld material. The 316 stainless steel base material had an even higher acceptable strain limit. Conservatively, the evaluation limited the strain of the base material to 0.55 in/in as well.

The drop analysis was performed using the finite element code LS-DYNA, which has been validated under Holtec's Quality Assurance Program, and was a method of evaluation that had been used in the UMAX FSAR for other canister analyses. The results of the analysis resulted in a maximum computed effective strain of 0.468 in/in, which was below the conservative limit of 0.55 in/in for both the base metal and weld material. NRC inspectors independently reviewed the analysis and concluded that the canister would not have breached had the canister fallen 18 feet to the bottom of the UMAX vault.

The condition of the fuel after the postulated drop and the canister's ability to continue to perform its safety function in the regards of pressure, thermal, criticality control, and shielding was analyzed in evaluation HI-2188261, and Storage Position Paper DS-470, "Expected Fuel Damage after MPC Drop," dated November 6, 2018. The analysis concluded that the damage would be mostly limited to deformation and buckling of lowest section of the fuel rods of the spent fuel assemblies. The inspectors independently reviewed each safety function analysis for accident conditions with regard to criticality, thermal performance, shielding, and pressure.

The inspectors concluded that expected temperature and pressure limits would have remained under the accident limits described in FSAR, criticality safety would have been maintained since the confinement boundary was not breached and the system remained dry, and external radiological dose rates of the canister, located in the vault, would have minimal increases. However, the condition of fuel after the postulated drop would not meet the licensing requirements for storage or transportation. The licensee would be required to perform either significant evaluations or supplemental operations to ensure

the safe retrieval, unloading, and re-packaging of the fuel while minimizing the dose to personnel.

b. Scratch Evaluation

As part of the corrective actions from the ACE 0818-20356 and RCE QI-2529, actions were taken to address the discrepancies within the UMAX FSAR, specifically the incidental contact that occurs when a canister was downloaded into the UMAX vault. The UMAX FSAR, Revision 4, Sections 1.2.4 and 9.5 vii, contained design statements that stated:

- Section 1.2.4, "Operational Characteristics of HI-STORM UMAX," *The vertical insertion (or withdrawal) of the MPC eliminates the risk of gouging or binding of the MPC with the CEC parts*

- Section 9.5 vii, "Regulatory Compliance," *Because the MPC insertion (and withdrawal) occurs in the vertical configuration with ample lateral clearances, there is no risk of scratching or gouging of the MPC's external surface (Confinement Boundary). Thus, the ASME Section III Class 1 prohibition against damage to the pressure retaining boundary is maintained.*

The HI-STORM UMAX MPC-37 used at SONGS is made of a type 316 stainless steel. It is approximately 76 inches in diameter and 17 feet tall. The 5/8" thick shell is made by seam welding together two cylinders of stainless steel rolled plate. The base plate of the MPC is approximately 3 inches thick and the top lid is 9 inches thick. Additionally, the divider shell inside the CEC of the UMAX vault is painted with a coating developed to assist in limiting scratches to the stainless steel canister during downloading.

The canisters for the Holtec UMAX Storage System are designed and licensed to meet the stress intensity limits per ASME Section III, Subsection NB for Class 1 pressure vessels. Localized scratches are examples of local structural discontinuities per the ASME Code definition in NB-3213.3. As such, the stresses attributed to these local discontinuities are categorized as peak stresses per NB 3213.11, which are "objectionable only as a possible source of a fatigue crack or brittle facture."

Chapter 3 of the HI-STORM FSAR states that the MPC is not vulnerable to fatigue failure or brittle fracture because of the passive nature of the HI-STORM UMAX system and its highly ductile material of construction (Type 316 austenitic stainless). Namely the amplitude of cyclic stresses and pressure pulsation is limited in the pressure vessel and remains orders of magnitude below the canister's material endurance limits. Moreover, peak stresses are not subject to a prescribed stress limit as summarized in FSAR Table 2.2.10 for primary and secondary stress categories.

Therefore, FSAR Section 3.1.2.5 states failure from fatigue is not a credible concern for the HI-STORM UMAX system components. Peak stresses are specifically addressed in Table 3.1.10 of the UMAX FSAR which states: "*Increment added to primary or secondary stress by a concentration (notch), or, certain thermal stresses that may cause fatigue but not distortion. Because fatigue is not a credible source of failure in a passive system with gradual temperature changes, the cumulative damage factor from fatigue is not computed for HI-STORM UMAX components.*" The NRC inspectors concluded that

the localized scratches (peak stresses) on the canister are not a safety concern from the standpoint of ASME Section III, Subsection NB stress intensity limits.

The SONGS canisters were designed and fabricated to contain a shell thickness of 1/8" (0.125 inch) thicker than the standard canister (0.50" nominal wall thickness) associated with the Holtec UMAX Storage System. Additionally, the canisters at SONGS have been laser peened which was developed, applied, and confirmed for SONGS to add a protective layer against high tensile stress over the heat affected zones of the canister seam welds to assist in possible elimination of future stress corrosion cracking concerns. Confirmed by laboratory tests performed by the vendor and licensee, the protective layer over the welds and heat affected zones resulted in an approximately 0.080" inch (80 mil) thick layer of additional protection.

The NRC determined that scratches that occur on the surface of the MPC during insertion and withdrawal due to incidental contact with the internal features of the CEC internals are not of any safety concern from a stress limit. However, allowing the MPC to scratch, or suffer mechanical wear, presented a potential impact to the MPC design basis requirements as specified in the technical specifications. The confinement design function is required by the Holtec Certificate of Compliance 072-01040, Appendix B Technical Specifications, Section 3.3 to meet ASME Section III acceptance limits.

The ASME Section III code acceptance limits for scratches is 10 percent of the nominal wall thickness per ASME Section III, NB-3324.1 Cylindrical Shells and NB-3213.10 Local Primary Membrane Stress, which specifies a local primary membrane stress limit of 1.1Sm (or 10 percent higher than the general primary membrane stress limit). The 10 percent allowance is consistent with NUREG 2214 "Managing Aging Processes in Storage Report," Table 6-2, that states flaws must be assessed in accordance with the acceptance standards identified in ASME Section XI IWB-3514 which provides allowable flaw depths that are below 10% of nominal wall thickness.

For the 0.625-inch thick MPC shell in use at SONGS the maximum allowable scratch depth would be 0.0625 inches per ASME Section III code and required by Technical Specification 3.3, Appendix B.

The licensee performed a change under the 10 CFR 72.48 process to evaluate and accept the scratches on canisters 1 thru 29 placed in the site's UMAX ISFSI. Through the 10 CFR 72.48 process the licensee revised the FSAR Section 1.2.4 and Section 9.5 vii. design statements to allow scratches to previous and future canisters during installation and retrieval. The 10 CFR 72.48 regulation permits a licensee to make changes to the spent fuel storage cask design as described in the FSAR without obtaining prior NRC approval as long as the change does not require a change to the technical specifications or the change does not conflict with the eight criteria of 10 CFR 72.48 (c)(2).

The calculation to demonstrate the maximum depth of any possible scratch from downloading operations was documented in Holtec Dry Storage Position Paper DS-469, "Incidence and Consequence of Canister Shell Scratching from Misaligned Insertion of a Loaded MPC at SONGS," dated November 7, 2018. The DS-469 calculation was used as the basis to support a 10 CFR 72.48 evaluation performed by the licensee. Position paper DS-469 calculated the maximum force on the canister shell during downloading based on dimensional tolerances of components and the maximum angle the canister

could be misaligned. The maximum force was calculated to be approximately 2400 pound-force (lbf).

The licensee's analysis utilized Archard's wear equation to calculate the maximum depth of a possible scratch from the carbon steel shield ring to be 0.010 inches (10 mils) based on the force of 2400 lbf. The NRC inspectors reviewed the calculation and identified several inadequacies with position paper DS-469. The inadequacies included: (1) the calculation did not address contact with the harder stainless steel seismic restraints and was only based on the contact with the softer carbon steel shield ring; (2) the evaluation lacked adequate review of corrosion deposits on the stainless steel canister; and (3) the written evaluation did not address scratches and gouges in the canister's seam weld areas.

The licensee addressed the inspectors' concerns in a subsequent evaluation, HI-2188437, "Incidence and Consequence of Canister Shell Wear Scars from Misaligned Insertion of a Loaded MPC at SONGS," dated March 1, 2019. The licensee's revised 10 CFR 72.48 evaluation contained more details and analysis, which was used as a basis for concluding the change did not require prior NRC approval. The inspectors observed that evaluation HI-2188437 utilized the same methodology as the DS-469 calculation which determined the maximum depth of a possible scratch would be less than 0.0091 inches or (9.1 mils).

However, the inspectors identified additional inadequacies associated with evaluation HI-2188437 which included: (1) the licensee utilized the wrong hardness values in the calculation; (2) the hardness values did not account for the temperature of the canister; (3) the calculations utilized the wrong sling lengths for determining initial point of contact for where contact on the MPC shell could occur; and (4) the inspectors did not agree that the calculation alone could provide adequate basis without empirical evidence (i.e. testing or inspection) to support the calculation's basis.

The licensee addressed the inspectors' concerns in a revision to evaluation HI-2188437, dated March 13, 2019. Additionally, the licensee's third written evaluation included test report HI-2188450, "Simulation of High Force Contact Between MPC and UMAX CEC Storage System Components," dated March 12, 2019. In the test report, simulations were performed using representative samples for the MPC shell and UMAX CEC components most likely to damage the MPC surface. The test simulations were conducted at Holtec's Orrvilon fabrication facility. The test simulations utilized a range of test loads to demonstrate what the maximum wear on a canister would be from contact with the UMAX CEC components. Scratch depths were measured after the completion of the test runs.

The evaluation HI-2188437 calculation was revised using Archard's wear equation to contain the correct hardness values and to account for temperature of the canister. The maximum possible scratch depth utilizing the same force had decreased to 0.0024 inches (2.4 mils). However, the test data reported in test report HI-2188450 found maximum depth of scratches on the samples, using a similar test load of 2,000 lbs, to have a maximum depth of 0.007 inches (7 mils). The NRC staff concluded that the licensee test data invalidated the licensee's calculation that utilized Archard's wear equation to define the maximum possible depth of a scratch on the canister.

Subsequently, the licensee determined that the Archard's wear equation only provided an estimate of abrasive wear (removal of material from a surface by harder material) but the calculation could not account for adhesive wear (localized bonding between contacting solid surfaces leading to material transfer between two surfaces or loss from either surface). The inspectors determined that the licensee's initial written evaluations which contained numerous errors and deficiencies were inadequate and represented a violation of NRC requirements (see Section 2.2.6).

Evaluation HI-2188437 had been revised to address corrosion, pitting, and corrosion induced stress corrosion cracking (CISCC). The evaluation stated, for CISCC to occur, three conditions were necessary; a susceptible material, a strong tensile stress, and a corrosive environment. Type 316 stainless steel is a resistant austenitic material, but CISCC is possible under sufficiently severe conditions. However, for CISCC to occur, a through-wall high tensile stress is needed. The primary tensile stresses for the storage system is due to internal pressure of the helium gas which is low (approximately 45 psi). Also, the residual stresses due to rolling operations on stainless steel plates introduced a compressive stress on the outside surface of the canister shell. Seam welds of the canister were the only areas where local tensile stresses from weld shrinkage could potentially result in a through wall high tensile stress.

However, as previously explained, the canisters purchased at SONGS have been laser peened over all the seam welds and heat affected zones to provide a layer of compressive stress relief of 0.080" depth. Additionally, water is necessary for CISCC. The UMAX vault canisters are sheltered from weather intrusion. The canisters are hotter than the ambient air, so wetting from condensation is not possible during the current licensing period. Specifically, the canisters' temperature would remain above ambient temperatures well beyond the current licensing expiration date of 20 years. As such, any additional required monitoring for corrosion, pitting, and CISCC would be addressed in license renewal and through the licensee's ageing management program. The inspectors concluded that the issues related to possible corrosion, pitting, and CISCC on the canister did not pose an immediate safety concern nor immediately affect any of the system's design basis functions and could be adequately monitored and addressed as part of the licensee's ageing management program.

The licensee's subsequent written evaluation to support the site-specific 10 CFR 72.48 change to allow and bound incidental contact used in-situ visual assessment of surfaces of the canister shell and baseplate from eight loaded canisters in the UMAX ISFSI at SONGS. The sample set of eight canisters was consistent with using the guidance of ANSI ASQ Z1.4, "Sampling Procedures and Tables for Inspection by Attributes." The visual assessment was documented in "SONGS Downloading Effects on HI-STORM MPC Visual Assessment Report," dated April 15, 2019.

The eight canisters selected for inspection included: 1.) MPC serial number (SN) 067, which was involved in the August 3, 2018, misalignment incident; 2.) MPC SN 064, which was documented as having made contact with the internals of the CEC on July 22, 2018; and 3.) six additional MPCs located on different rows than the previous two MPCs. The different rows were selected to account for the drainage slope on the ISFSI pad and its potential effect on canister vertical alignment during downloading operations.

The visual assessment was performed by a robotic crawler equipped with navigational cameras and a borescope. The borescope was a flexible camera with interchangeable tips (general area tip and measurement tip). Two stages were utilized to perform the visual assessment. During the first stage, the robotic crawler and borescope with the general area tip was used to identify general locations of surface irregularities. During the section stage, the robotic crawler with the borescope using the measurement tip characterized the surface irregularities (width and depth measurements as applicable). The equipment selected by the licensee to perform the visual assessment was the General Electric borescope (VideoProbe™), along with the Robotic Technologies of Tennessee robot.

This same equipment had been used by Electric Power Research Institute for their Extended Storage Collaboration Program Non-destructive examination subcommittee, which is researching and developing technology to support inspection of dry storage canisters. This equipment had been used at multiple U.S. nuclear sites for Part 72 license renewal applications. The GE inspection Technologies' VideoProbe with Real3D™ point cloud surface scanning and analysis had been used in aviation, military, and oil & gas applications. Additionally, an NRC inspector was on-site during seven of the eight canister inspections to observe the visual assessment activities.

All surface irregularities were recorded and compared to post-fabrication photos to determine whether the surface irregularities were a result of downloading operations. All irregularities that were identified to have occurred during downloading operations were recorded and characterized. A few identified areas of interest crossed over or resided within the canisters' seam welds or weld heat affected zones. However, the protective layer of 0.080 inches provided by laser peening operations was never exceeded. The majority of wear marks identified were correlated to contact with the divider shell shield ring and had maximum wear depths of up to 0.012 inches (12 mils) deep. Additional wear marks identified were correlated to contact with seismic restraints and a maximum wear depth was 0.026 inches (26 mils) deep. Many wear marks had negligible depths.

Wear profiles for divider shell shield ring and inner seismic restraints were different. The divider shell ring wear marks were broader and shallower in comparison. The maximum depth caused by the stainless inner seismic restraint occurred over relatively short lengths in a localized narrow area and did not apply over the entire length nor width of the wear mark. In summary, the wear marks from incidental contact were not uniform, the maximum depths observed were very small in width and area and a majority of the scratch lengths contained negligible depths.

With the gathered information from the visual assessment report, the licensee performed two statistical analyses to bound the potential wear mark depths on the remaining canisters. Licensee report MPR 0299-0057-MEMO-001, "Canister Inspection Plan," dated April 15, 2019, concluded that the eight canister measurements were sufficient to support a conclusion that there is a 95 percent probability with 95 percent confidence that each of the remaining and future canisters would not have a scratch deeper than 0.035 inches (35 mils) due to downloading operations.

The second statistical analysis was documented in licensee report MPR 0299-0042-MEMO-024, "Canister Installation and Removal Effects on Wall Thickness," dated May 5, 2019. This statistical analysis determined the deepest scratch resulting from insertion and then withdrawal and assumed the two scratches occurred in

the same location. The licensee utilized the same methodology and determined that the deepest scratch at one location resulting from insertion followed by withdrawal with a 95 percent probability and 95 percent confidence to be 0.0584 inches (58 mils), which was still below the ASME code limit of 10 percent (0.0625 inches).

The NRC inspectors utilized the data obtained through the visual assessments to perform independent statistical assessments using several models that were appropriate for the sample size. The inspectors concluded, through the independent assessments, that the conclusion presented by SCE was conservative and reasonably bounded the maximum anticipated scratch or wear resulting from operational activities.

As such, the licensee's written evaluation using the visual assessments and statistical evaluations was adequate to demonstrate that the proposed change to allow the incidental contact on previous and future canisters will continue to meet the confinement design functions as specified in the FSAR and ASME Section III code tolerances and does not require a change to the storage system's technical specifications. The inspectors found that the licensee's site-specific 10 CFR 72.48 change to be acceptable and met all applicable criteria to not require NRC review and approval through a Certification of Compliance amendment.

2.2.6 Finding Related to 10 CFR 72.48 Evaluations

10 CFR 72.48(d)(1) requires, in part, that the licensee and certificate holder shall maintain records of changes in the facility or spent fuel storage cask design, of changes in procedures, and tests and experiments made pursuant to paragraph (c) of the section. These records must include a written evaluation, which provides the bases for the determination that the change does not require a Certificate of Compliance (CoC) amendment pursuant to paragraph (c)(2) of this section.

Contrary to the above, from November 7, 2018, to April 15, 2019, on two occasions the licensee did not maintain records of changes that included a written evaluation that provided the bases for the determination that the change does not require a CoC amendment pursuant to paragraph (c)(2) of 10 CFR 72.48. Specifically, the first two revisions of the 10 CFR 72.48 written evaluations to allow scratching on canisters failed to provide an adequate basis for determination that the change did not require a CoC amendment. As noted in Section 2.2.5.b of this report, the inspectors identified numerous technical errors with the calculations used as the bases for the 10 CFR 72.48 written evaluations. In addition, the first two revisions of the licensee's written evaluation did not demonstrate that the maximum possible scratch depth would not exceed ASME Section III code limits, a technical specification requirement.

The inspectors determined that the finding was of low safety significance because the inspectors assessed that the in-situ visual assessment and statistical analysis provided an adequate basis for the determination that the canister will continue to meet structural and confinement design functions as specified in the FSAR and continue to meet ASME Section III code tolerances.

The inspectors determined that the violation was similar to the violation examples in Section 2.1.3.D.5 of the NRC Enforcement Manual, which states that violations of 10 CFR 50.59 will be considered more than minor and categorized at Severity Level IV if

the licensee failed to perform an adequate 10 CFR 72.48 evaluation, similar to a 10 CFR 50.59 evaluation, that resulted in a condition having low safety significance.

Consistent with the guidance in Section 1.2.6.D of the NRC Enforcement Manual, if a violation does not fit an example in the enforcement policy violation examples, it should be assigned a severity level: (1) commensurate with its safety significance, and (2) informed by similar violations addressed in the violation examples. The violation was evaluated to be similar to Enforcement Policy Section 6.1.d.2.

The licensee entered the finding into the CAP as AR 1218-11302 and AR 0219-96601. The licensee restored compliance by revising the written evaluation to provide an adequate basis to conclude the change did not require NRC approval. Specifically, the revised written evaluation provided a basis that incidental contact of the canister with the internal components of the CEC during insertion and withdrawal operations would not remove greater than 10% nominal wall thickness of the canister in accordance with ASME Section III which was required by Appendix B Technical Specification 3.3 requirements. Because the licensee entered the issue into the CAP, the safety significance of the issue was low, and the issue was not repetitive or willful, this Severity Level IV violation was treated as a NCV, consistent with Section 2.3.2.a of the NRC Enforcement Policy (NCV 07200044/2018-002-04, Failure to provide adequate written basis for 72.48 change (10 CFR 72.48)).

2.2.7 (Closed) Unresolved Item 07200041/2017-001-02, 10 CFR 72.48 Methodology

NRC Inspection Report 05000206/2017-003, 05000361/2017-003, 05000362/2017-003, and 07200041/2017-001 dated, August 24, 2018 (ADAMS Accession ML18200A400), documented an Unresolved Item (URI) 07200041/2017-001-02, "10 CFR 72.48 Methodology." The issue related to a 10 CFR 72.48 evaluation for the scenario of a hypothetical accident of the loaded HI-TRAC VW transfer cask contacting the sides and bottom of the spent fuel pool, which was analyzed in report HI-2177713 "HI-TRAC VW Drop in Cask Storage Pool at SONGS," Revision 1.

For a short period of time, the HI-TRAC VW and loaded MPC was in an unconstrained condition on an intermediate shelf in the spent fuel pool. If a DBE seismic event was to occur during that time frame, the HI-TRAC VW with a loaded MPC could hypothetically fall to the lower level of the spent fuel pool and experience a higher lateral force than previously analyzed by the HI-STORM FW and UMAX FSARs. In report HI-2177713, the licensee demonstrated acceptability of the peak impact deceleration for the HI-TRAC VW scenario at SONGS by comparing those lateral forces to the peak impact deceleration values used to support the 10 CFR Part 71 HI-STAR 190 transport package safety analyses which utilized the same canister.

The licensee's evaluation concluded that the maximum peak lateral deceleration value of the HI-TRAC VW in the pool at SONGS to be 74g's, which was below the HI-STAR 190 side drop evaluation of 85.9g's. Additionally, the MPC and fuel basket evaluated stresses were identified by the licensee to be less than the design basis criteria described in the limiting values from HI-STORM FW FSAR, Section 2.2.8. The licensee stated that the same computer software (LS-DYNA) was utilized in all three evaluations (SONGS site-specific drop evaluation, HI-STORM FW/UMAX FSAR non-mechanistic tip-over evaluation, and HI-STAR FSAR transportation cask drop evaluation).

At the time of the initial inspection, the NRC needed more information to determine if the utilization of evaluations conducted for the 10 CFR Part 71 HI-STAR 190 transportation license to bound conditions for storage operations under 10 CFR Part 72 UMAX license through SONGS's 10 CFR 72.48 process was appropriate and in compliance with NRC regulations. The NRC subsequently determined that licensee's change was in violation of 10 CFR 72.48 requirements.

The UMAX FSAR references the FW FSAR for the use of the HI-TRAC VW, also both FSARs discuss various tip-over/drop events or requirements that must be followed such that a tip-over/drop event is not credible.

The FW FSAR, Table 1.2.10, "Criteria for Site-Specific Safety Qualification of HI-TRAC VW," item #10 states, in part, *the transfer cask's kinematic stability is established under all loading evolutions where the cask is freestanding to ensure kinematic compliance (no tip-over or collision with a proximate structure).*

Additionally, a tip-over/drop event as well as kinematic stability of a canister in a HI-TRAC VW was described as either a non-credible accident or must be demonstrated per analysis to have kinematic stability for tornado missiles (FW Section 2.2.3 e.), cask handling (FW Section 2.2.3 f.), and transportation operations (UMAX Appendix B, Technical Specification 3.4.15).

Nuclear Energy Institute Guidance Document 96-07, Appendix B, "Guidelines for 10 CFR 72.48 Implementation," Section 4.3.5, states that, "a change or activity, which increases the frequency of an accident previously thought to be incredible to the point where it becomes as likely as the accidents in the FSAR, could create the possibility of an accident of a different type."

10 CFR 72.48 (c)(1)(ii)(C) states in part, a licensee may make a change in the facility or spent fuel storage cask design as described in the FSAR without obtaining a CoC amendment if the change does not meet any of the criteria in paragraph (c)(2).

10 CFR 72.48 (c)(2)(v) states in part, a general licensee shall request that the certificate holder obtain a CoC amendment pursuant to 10 CFR 72.244, prior to implementing a proposed change if the change would: Create a possibility for an accident of a different type than any previously evaluated in the FSAR.

Contrary to the above, from January 30, 2018, to August 3, 2018, the licensee made a change in the spent fuel storage cask design as described in the FSAR and failed to request the certificate holder to obtain a CoC amendment prior to implementing the proposed change which created a possibility of an accident of a different type than any previously evaluated in the FSAR. Specifically, the licensee created the possibility of a new accident not previously analyzed in the FSAR through a 10 CFR 72.48 change (10 CFR 72.48 Assignment 0718-10512-3) to allow placement of a loaded HI-TRAC VW cask on an intermediate shelf in the spent fuel pool which was evaluated, by the licensee, to not be kinematically stable and had the potential to collide with proximate structures during a seismic event.

This violation was dispositioned per the traditional enforcement process using Section 2.3 of the NRC's Enforcement Policy. The inspectors determined that the finding was of low safety significance since the accident condition of a spent fuel cask

drop (due to a seismic event) from the intermediate shelf in the cask pool to the lower portion of the cask pool was an accident condition that had been analyzed and NRC approved in NUREG-0712, "Safety Evaluation Report related to the operation of SONGS Units 2 and 3, dated February 1981," and described in the SONGS Decommissioning Safety Analysis Report Section 15.1.1.5. Additionally, the licensee's calculations demonstrated that maximum lateral deflection in the fuel basket's active fuel region would not have exceeded requirements in the Holtec FW FSAR.

The inspectors determined that the violation was similar to the violation examples in Section 2.1.3.D.5 of the NRC Enforcement Manual, which states that violations of 10 CFR 50.59 will be considered more than minor and categorized at Severity Level IV if the licensee failed to request a license amendment, the NRC would likely approve the amendment, and the change resulted in a condition having low safety significance.

Consistent with the guidance in Section 1.2.6.D of the NRC Enforcement Manual, if a violation does not fit an example in the Enforcement Policy Violation Examples, it should be assigned a severity level: (1) commensurate with its safety significance; and (2) informed by similar violations addressed in the Violation Examples. The violation was evaluated to be similar to Enforcement Policy Section 6.1.d.2

The licensee entered the issue into the CAP as AR 0718-10512 and AR 0617-86918. The licensee restored compliance by revising the loading procedures to no longer utilize the intermediate shelf in the pool. The revised procedures required the transfer cask to be moved, after spent fuel assembly loading, from the bottom of the spent fuel pool directly to the cask wash-down pit for further processing (see Section 2.2.8). Because the licensee entered the issue into the CAP, the safety significance of the issue was low, and the issue was not repetitive or willful, this Severity Level IV violation was treated as a NCV, consistent with Section 2.3.2.a of the Enforcement Policy (NCV 07200044/2018-002-05, Failure to request the certificate holder to obtain a CoC amendment (10 CFR 72.48)).

No additional deficiencies were identified during the review of the Unresolved Item. This Unresolved Item 07200041/2017-001-02, "10 CFR 72.48 Methodology," is closed.

2.2.8 Dry Runs (Transportation, Downloading, Uploading)

Week of January 28, 2019

During the week of January 28, 2019, inspectors observed SCE perform demonstrations of sections of revised procedures HPP-2464-400, "MPC Transfer at SONGS," Revision 19 and HPP-2464-500, "MPC Unloading at SONGS," Revision 6. The demonstrations for this week of NRC on-site inspection activity involved movement of the HI-TRAC VW transfer cask with a canister simulator from the Unit 2 fuel building along the haul path to the ISFSI pad and included downloading operations.

During the first day of field demonstrations, SCE demonstrated spent fuel travel along a revised travel path for the low-profile transporter while carrying the canister simulator and HI-TRAC VW transfer cask from the Unit 2 fuel building. The haul path was revised based on seismic analyses and the revisions were intended to keep the low-profile transporter and transfer cask the required height and distance from structures along the path that could possibly be impacted if a seismic event were to occur during travel. The

revised path included white and yellow painted lines on the pavement to serve as guides for the operator to travel within. There were also restricted zone markings on the haul path near adjacent structures that were required to be avoided. The transfer cask was transported by the operator from the fuel building to the outside of the plant protected area, and into the SONGS ISFSI protected area, where it met up with the VCT. The VCT continued the movement of the canister simulator onto the ISFSI pad and into stack-up configuration for downloading.

The transfer cask was transported by use of the VCT until it was secured to the UMAX ISFSI mating device. A nighttime downloading demonstration of the canister simulator was performed after the ISFSI haul path travel demonstration. No adverse conditions were identified during the downloading demonstration operations. The new load monitoring equipment, cameras, and personnel present on the ISFSI pad ensured that loss-of-load indications was promptly responded to during downloading operations. The new equipment worked as intended and provided a positive load indication for the canister simulator. The cask loading crew used procedure adherence and the equipment enhances at their disposal to successfully perform the nighttime downloading demonstration.

The following day, the cask loading crew used the most recent revision of procedure HPP-2464-500 to demonstrate removal of the simulator from the UMAX ISFSI vault. Uploading operations proceeded without any issues. In the same manner as the previous evening, the cask loading crew used procedure adherence and the equipment enhancements at their disposal to successfully retrieve the canister simulator from the ISFSI vault.

Finally, a daytime downloading operation was demonstrated in accordance with procedure HPP-2464-400. The daytime downloading proceeded with the same requirements as the nighttime demonstration. The inspectors observed rigorous procedure adherence and oversight supervision during the cask loading operations.

Week of February 11, 2019

During the week of February 11, 2019, NRC observed SCE perform demonstrations of sections of its revised procedures HPP-2464-400, "MPC Transfer at SONGS," Revision 19, and HPP-2464-500, "MPC Unloading at SONGS," Revision 6, inside the fuel building. The second-week demonstrations were performed to support procedure revisions that removed usage of the spent fuel pool intermediate shelf location during fuel loading operations. To remove usage of the intermediate shelf required that the crane hook be fully immersed into the pool when placing the transfer cask and empty canister into the cask loading pit. The previous procedure revision avoided immersing the crane hook, block, and wire rope into the potentially contaminated spent fuel pool water.

To facilitate the procedure revisions, SCE performed modifications to the Unit 2 cask handling crane hook that would allow it to be immersed into the spent fuel pool water. At the time of the inspection, the Unit 3 cask handling crane hook had not yet been modified. However, the inspectors noted that the work orders were in place for the modification.

The inspectors observed SCE successfully demonstrate placement of an empty transfer cask and canister into the spent fuel cask loading pit. Next, the licensee successfully demonstrated placement of the MPC lid and drain tube into the transfer cask while at the bottom of the cask loading pit and removal of the transfer cask from the cask loading pit to the cask washdown area. The inspectors observed rigorous procedure adherence and oversight supervision during the fuel loading operations.

2.2.9 (Closed) Notice of Violation SLII 072-00041/2018-001-02, "Failure to ensure redundant drop protection features were available" (10 CFR 72.212), EA-18-155

As a result of the NRC Special Inspection a violation was identified for the licensee's failure to provide redundant drop protection features during downloading operations.

The licensee submitted its response to the NRC letter within the required 30-day time frame, on April 23, 2019 (ADAMS Accession ML19116A056), which contained the corrective steps taken to ensure full compliance was achieved.

During supplemental inspection activities conducted from November 2018 to May 2019, the NRC inspectors concluded that SCE's proposed and completed corrective actions, as described in this report, restored compliance, addressed extent of condition, and were adequate to prevent recurrence. No additional deficiencies were identified during NRC's review of this violation.

This closes VIO 072-00041/2018-001-02, "Failure to ensure redundant drop protection features are available," (10 CFR 72.212), EA-18-155.

2.2.10 ISFSI Pad Surveys

On October 22, 2018, during a routine decommissioning inspection (ADAMS Accession ML18323A024) the NRC inspectors performed independent measurements and verifications of the radiological conditions at the SONGS ISFSI. The inspectors measured various locations including the background areas, public access areas, owner-controlled areas, protected areas, and representative locations on both generally licensed ISFSI Pads: Transnuclear, (TN) Inc. Nuclear Horizontal Modular Storage (NUHOMS) and Holtec HI-STORM UMAX dry fuel storage systems.

The inspectors used a Ludlum Model 19, NRC Tag Number 033906, serial number 84259 with a calibration due date of July 23, 2019, to perform the survey measurements. The data in Attachment 2 shows the ranges of the measurements of each UMAX location by the VVM number at the inlet air vents, closure lid, and outlet air vent. Attachment 2, also shows the measurements taken on the NUHOMS locations, on contact with the inlet vent and 1 foot away from the inlet vent.

The VVM with the highest gamma measurement was VVM 33 with the inlet air vents ranging from 310-330 µR/hr. The NUHOMS location with the highest gamma measurement was TN 21, on contact with the inlet vent was 1,600 µR/hr. Background measurements from around the site ranged from 3-10 µR/hr. The NRC inspectors did not identify any measurements at the owner-controlled area boundary or in the public access areas to be above normal background measurements. A more detailed discussion of the surveys taken can be found at "NRC Surveys of SONGS ISFSI Pad,"

dated October 22, 2018 (ADAMS Accession ML19011A457) and on the provided table in Attachment 2 of this report.

### 2.3 Conclusions

The inspectors reviewed two LERs and one licensee event notification which had been reported to the NRC since the last inspection. The review of the event notification resulted in one Severity Level IV violation of NRC requirements that was treated as a NCV. The inspectors reviewed inspection follow-up items from the NRC Special Inspection Report which included the NRC's evaluation of the licensee's drop analysis, scratch analysis, and observations of dry run demonstrations. The review of the scratch analysis resulted in one Severity Level IV violation of NRC requirements that was treated as a NCV. The inspectors closed one violation which resulted from the NRC Special Inspection for the licensee's failure to ensure redundant drop protection features during downloading operations on August 3, 2018. The inspectors documented the results of the independent measurements and verifications of the radiological conditions at the SONGS ISFSI.

## 3 Exit Meeting Summary

On February 15, 2019, following an onsite portion of the inspection, the inspectors provided a debrief of the preliminary results to Mr. Doug Bauder, Vice President and Chief Nuclear Officer, and other members of the licensee staff. The licensee acknowledged the issues presented by the NRC inspection team.

On March 25, 2019, the NRC performed a public webinar meeting to discuss the inspection team's preliminary results. On March 28, 2019, the NRC participated in a San Onofre Community Engagement Panel Meeting to discuss the inspection team's preliminary results. On June 3, 2019, the NRC performed a public webinar meeting to discuss the NRC's decision on resumption of fuel loading activities at SONGS. On June 5, 2019, the NRC participated in a San Onofre Community Engagement Panel Meeting and discussed the NRC's decision on resumption of fuel loading activities at SONGS.

On June 13, 2019, the inspectors presented the final inspection results to Mr. Al Bates, Regulatory and Oversight Manager and other members of the licensee staff. The licensee acknowledged the issues presented.

## SUPPLEMENTAL INSPECTION INFORMATION

## PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

A. Bates, Regulatory and Oversight Manager
M. Morgan, Regulatory and Oversight
L. Bosch, Plant Manager
T. Palmisano, former Vice President Decommissioning and Chief Nuclear Officer
J. Pugh, Project Engineer
K. Rod, General Manager Decommissioning Oversight
J. Smith, Project Manager, Holtec
M. Soler, Vice President Quality, Holtec

## INSPECTION PROCEDURES USED

| | |
|---|---|
| IP 92702 | Follow-up on Traditional Enforcement Actions |
| IP 71153 | Follow-up of Events and Notices of Enforcement |

## LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened and Closed

| | | |
|---|---|---|
| 07200044/2018-002-01 | NCV | Failure to ensure appropriate quality standards (10 CFR 72.146) |
| 07200044/2018-002-02 | NCV | Failure to ensure purchased material conformed to the procurement documents (10 CFR 72.154) |
| 07200044/2018-002-03 | NCV | Failure to ensure the loaded transfer cask and its conveyance was evaluated under the site-specific DBE (10 CFR 212) |
| 07200044/2018-002-04 | NCV | Failure to provide adequate written basis for 72.48 change (10 CFR 72.48) |
| 07200044/2018-002-05 | NCV | Failure to request the certificate holder to obtain a CoC amendment (10 CFR 72.48) |

Closed

| | | |
|---|---|---|
| 072-00041/2018-001-01 | VIO | Failure to identify and correct conditions adverse to quality (10 CFR 72.172) EA-18-155 |
| 072-00041/2018-001-02 | VIO | Failure to ensure redundant drop protection features were available (10 CFR 72.212) EA-18-155 |

| | | |
|---|---|---|
| 072-00041/2018-001-03 | VIO | Failure to assure that operations of important to safety equipment were limited to trained and certified personnel (10 CFR 72.190) EA-18-155 |
| 072-00041/2018-001-04 | VIO | Failure to provide adequate instructions or procedures (10 CFR 72.150) EA-18-155 |
| 072-00041/2018-001-05 | VIO | Failure to make 24-hour notification (10 CFR 72.75) EA-18-155 |
| 2018-001-0 | LER | Spent Nuclear Fuel Canister Temporarily Wedged in Dry Cask Storage Container |
| 53858 | EN | Inadequate Analysis for VCT Operations |
| 07200041/2017-001-02 | URI | 10 CFR 72.48 Methodology |

Discussed

| | | |
|---|---|---|
| 2018-002-0 | LER | Spent Nuclear Fuel Transport Conveyance Vehicle Operated Outside Obstacle Clearance Limit |

## LIST OF ACRONYMS USED

| | |
|---|---|
| ACE | Apparent Cause Evaluation |
| ADAMS | Agencywide Documents Access and Management System |
| AHSM | Advanced Horizontal Storage Module |
| ASME | American Society of Mechanical Engineers |
| AR | Action Request |
| ASME | American Society of Mechanical Engineers |
| AV | Apparent Violation |
| CA | Corrective Action |
| CAP | Corrective Action Program |
| CAPR | Corrective Action to Prevent Recurrence |
| CCE | Common Cause Evaluation |
| CEC | Cavity Enclosure Container |
| CFR | *Code of Federal Regulations* |
| CISSC | corrosion induced stress corrosion cracking |
| CoC | Certificate of Compliance |
| DBE | Design Basis Earthquake |
| EN | Event Notification |
| FCR | Field Condition Report |
| FSAR | Final Safety Analysis Report |
| GTCC | Greater than Class C |
| HI-STORM FW | Holtec International Storage Module Underground Flood and Wind |
| HI-STORM UMAX | Holtec International Storage Module Underground Maximum Capacity |
| IP | Inspection Procedure |
| ISFSI | Independent Spent Fuel Storage Installation |
| ITS | Important-to-Safety |
| LER | Licensee Event Report |
| NECP | Nuclear Engineering Change Package |
| NCV | Non-Cited Violation |
| NITS | Not-Important-to-Safety |
| NRC | U.S. Nuclear Regulatory Commission |
| NUHOMS | Nuclear Horizontal Modular Storage |
| MPC | multipurpose canister |
| QI | Quality Investigation |
| RCE | Root Cause Evaluation |
| RRCE | Reportability Root Cause Evaluation |
| SAT | Systematic Approach to Training |
| SCE | Southern California Edison |
| SL | Severity Level |
| SONGS | San Onofre Nuclear Generating Station |
| TN | Transnuclear |
| VCT | Vertical Cask Transporter |
| VIO | Violation |
| VVM | Vertical Ventilated Module or vault |

## Radiological Surveys of ISFSI Pads

**Table 1, Holtec HI-STORM UMAX ISFSI Pad Survey Results**

| Vertical Ventilated Module | Inlet Air Vent Range (μR/hr) | Closure Lid Range (μR/hr) | Outlet Air Vent Range (μR/hr) |
|---|---|---|---|
| 22 | 130-160 | 9-15 | 110-120 |
| 23 | 170-230 | 12-17 | 150-160 |
| 24 | 180-240 | 11-14 | 150-170 |
| 25 | 210-240 | 11-17 | 170-190 |
| 26 | 180-230 | 11-16 | 130-140 |
| 27 | 160-220 | 9-17 | 140-160 |
| 28 | 230-300 | 14-19 | 210-220 |
| 29 | 200-320 | 13-18 | 190-210 |
| 30 | 190-280 | 12-19 | 180-190 |
| 31 | 190-220 | 13-19 | 170-180 |
| 32 | 200-260 | 13-18 | 170-190 |
| 33 | 310-330 | 13-18 | 230-240 |
| 44 | 220-260 | 14-21 | 180-200 |
| 45 | 180-250 | 14-20 | 190-210 |
| 46 | 270-320 | 15-22 | 220-240 |
| 47 | 180-250 | 11-20 | 170-180 |
| 58 | 130-180 | 11-17 | 120-160 |
| 59 | 150-200 | 14-20 | 130-150 |
| 60 | 170-200 | 15-19 | 140-160 |
| 61 | 160-200 | 11-18 | 140-150 |
| 67 | 140-210 | 11-17 | 140-150 |
| 68 | 120-160 | 11-16 | 130-140 |
| 69 | 160-210 | 11-16 | 140-160 |
| 70 | 180-210 | 13-18 | 140-150 |
| 71 | 190-220 | 11-17 | 140-160 |
| 72 | 120-190 | 11-15 | 140-160 |
| 73 | 180-220 | 11-17 | 150-170 |
| 74 | 160-180 | 11-16 | 130-160 |
| 75 | 100-260 | 11-16 | 180-210 |

**Table 2, TN, Inc. NUHOMS ISFSI Pad Survey Results**

| AHSM | Inlet Vent Contact (μR/hr) | Inlet Vent 1 Foot Away (μR/hr) |
|---|---|---|
| 1 | 800 | 500 |
| 2 | 700 | 500 |
| 3 | 800 | 500 |
| 4 | 800 | 500 |
| 5 | 700 | 500 |
| 6 | 700 | 500 |
| 7 | 600 | 400 |
| 8 | 700 | 500 |

| AHSM | Inlet Vent Contact (µR/hr) | Inlet Vent 1 Foot Away (µR/hr) |
|---|---|---|
| 9 | 700 | 500 |
| 10 | 600 | 400 |
| 11 | 800 | 500 |
| 12 | 700 | 500 |
| 13 | 600 | 400 |
| 14 | 500 | 300 |
| 15 | 100 | 70 |
| 16 | 420 | 260 |
| 17 | 440 | 240 |
| 18 | 440 | 270 |
| 19 | 1400 | 900 |
| 20 | 1300 | 1000 |
| 21 | 1600 | 1100 |
| 22 | 1000 | 700 |
| 23 | 1000 | 700 |
| 24 | 900 | 600 |
| 25 | 600 | 400 |
| 26 | 380 | 220 |
| 27 | 1000 | 600 |
| 28 | 800 | 600 |
| 29 | 1000 | 700 |
| 30 | 1200 | 800 |
| 31 | 800 | 500 |
| 32 | 1200 | 700 |
| 33 | 900 | 500 |
| 34 | 1100 | 800 |
| 35 | 900 | 500 |
| 36 | 1100 | 700 |
| 37 | 1000 | 600 |
| 38 | 1200 | 800 |
| 39 | 1000 | 600 |
| 40 | 1100 | 700 |
| 41 | 1100 | 700 |
| 42 | 1100 | 700 |
| 43 | 320 | 180 |
| 44 | 320 | 180 |
| 45 | 310 | 170 |
| 46 | 310 | 210 |
| 47 | 310 | 180 |
| 48 | 900 | 600 |
| 49 | 700 | 500 |
| 50 | 360 | 210 |
| 51 | 360 | 220 |