



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

May 20, 2013

EA-13-090

Mr. Edward D. Halpin  
Senior Vice President and  
Chief Nuclear Officer  
Pacific Gas and Electric Company  
Diablo Canyon Power Plant  
P.O. Box 56, Mail Code 104/6  
Avila Beach, CA 93424

**SUBJECT: DIABLO CANYON POWER PLANT INDEPENDENT SPENT FUEL STORAGE  
INSTALLATION (ISFSI) INSPECTION REPORT 05000275/2013008,  
05000323/2013008, 07200026/2013001, AND NOTICE OF VIOLATION**

Dear Mr. Halpin:

This letter refers to a routine inspection conducted on April 2 - 4, 2013, of your dry cask storage activities associated with your Independent Spent Fuel Storage Installation (ISFSI). The inspection was conducted to confirm compliance with the requirements specified in the Technical Specifications associated with Materials License No. SNM-2511, the Diablo Canyon ISFSI Final Safety Analysis Report (FSAR), and Title 10 of the Code of Federal Regulations (CFR) Part 20 and Part 72. Within these areas, the inspection included a review of radiation safety, cask thermal monitoring, quality assurance, corrective action program, safety evaluations, cask maintenance, and how you addressed industry issues that affected your ISFSI program. Also reviewed, were changes made to your ISFSI program since the last ISFSI inspection conducted by the U.S. Nuclear Regulatory Commission (NRC). An exit was conducted with your staff to discuss the findings of the inspection on April 4, 2013. However, during the in-office review, a violation of NRC regulations was identified. On April 30, 2013, a final exit was conducted by telephone, with members of your management and staff.

Based on the results of this inspection, the NRC has determined that a Severity Level IV violation of NRC requirements occurred. The violation involved an inadequate safety review of a procedure, as required by 10 CFR 72.48. The procedure contained steps that isolated the canister while loaded with spent fuel and filled with water. The canister was isolated with no release path or access to a pressure relief valve. This placed the canister in an unanalyzed condition with the possibility of creating an accident condition not analyzed in the FSAR. This violation was evaluated in accordance with the NRC Enforcement Policy. The current Enforcement Policy is included on the NRC's Web site at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>.

The violation is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it are described in detail in the subject inspection report. The violation is being cited because Diablo Canyon (1) was notified of a potential non-compliance in its procedure by the cask vendor (Holtec); (2) failed to restore compliance within a reasonable period of time; (3) failed to place the issue in the corrective action program prior to the 2012 loading campaign; and (4) proceeded to use the procedure, which subsequently placed seven canisters in an unanalyzed condition from January 2012 through March 2012.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. If you have additional information that you believe the NRC should consider, you may provide it in your response to the Notice. The NRC review of your response to the Notice will also determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agency-wide Document Access Management System (ADAMS), accessible from the NRC Web site 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.

Should you have any questions concerning this inspection, please contact me at 817-200-1191 or Mr. Lee Brookhart at 817-200-1549.

Sincerely,

***/RA by Jack E. Whitten Acting for/***

D. Blair Spitzberg, Ph.D. Chief  
Repository & Spent Fuel Safety Branch  
Division of Nuclear Materials Safety

Dockets: 50-275, 50-323, 72-26  
Licenses: DPR-80, DPR-82, SNM-2511

Enclosures:

1. Notice of Violation
2. Inspection Reports 05000275/2013008, 05000323/2013008, and 07200026/2013001

w/attachments:

1. Supplemental Information
2. Loaded Casks at Diablo Canyon Power Plant ISFSI

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See next page

FINAL: R:\\_REACTORS\\_\_DC\2013\DC2013008-ISFSI-LEB

ADAMS: <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> SUNSI Review Complete	Reviewer Initials: LEB	
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RIV:DNMS/RSFS	RIV:DNMS/RSFS	RIV:OE	R-IV/C:RSFS
LEBrookhart: jm *	EJSimpson	RSBrowder	DBSpitzberg
/By email/	/RA D.Blair Spitzberg for/	/RA/	/RA by JEWhitten for/
05/09/2013	05/17/2013	05/16/2013	05/20/2013

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Letter to Edward Halpin from D. Blair Spitzberg, dated May 20, 2013.

SUBJECT: DIABLO CANYON POWER PLANT INDEPENDENT SPENT FUEL STORAGE  
INSTALLATION (ISFSI) INSPECTION REPORT 05000275/2013008,  
05000323/2013008, 07200026/2013001, AND NOTICE OF VIOLATION

**DISTRIBUTION w/attachments:**

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ROPreports

## NOTICE OF VIOLATION

Pacific Gas and Electric Company  
Diablo Canyon Power Plant

Docket Nos. 50-275, 50-323, 72-26  
License Nos. DPR-80, DPR-82, SNM-2511  
EA-13-090

During a routine Independent Spent Fuel Storage Installation (ISFSI) inspection conducted on April 2 - 4, 2013, a violation of the U.S. Nuclear Regulatory Commission (NRC) requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

10 CFR 72.48(c)(1)(i)(C), requires, in part that a licensee or certificate holder may make changes in the facility or spent fuel storage cask design as described in the Final Safety Analysis Report (FSAR)(as updated), make changes in the procedures as described in the FSAR (as update) without obtaining a license amendment pursuant to 10 CFR 72.56, if the change does not meet any of the criteria in paragraph (c)(2) of this section.

10 CFR 72.48(c)(2)(v) requires, in part, that a specific licensee shall obtain a license amendment pursuant to 10 CFR 72.56, 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 (as updated).

Contrary to the above, from late January 2012 through March 2012, the licensee failed to obtain a license amendment pursuant to 10 CFR 72.56, prior to implementing a proposed change that would create a possibility for an accident of a different type than previously evaluated in the FSAR (as updated). Specifically, the licensee made changes to Procedure HPP-1073-300, "Procedure for Drying, Backfill, and Sealing the MPC at DCP," Revision 9, which allowed the licensee to take steps that were not consistent with Chapter 5 of the FSAR and resulted in the isolation of the canister, while filled with water, which created the possibility of an accident not evaluated in the FSAR. Diablo Canyon used this procedure and implemented the steps which resulted in an unanalyzed condition, during the loading of seven casks from January 2012 through March 2012.

This is a Severity Level IV violation (Section 6.1.d.2).

Pursuant to the provisions of 10 CFR 2.201, Pacific Gas and Electric Company is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with a copy to the Regional Administrator, Region IV, (c/o Blair Spitzberg, Ph.D., Chief, Repository Spent Fuel Safety Branch, DNMS) and a copy to the NRC Resident Inspector at Diablo Canyon Power Plant, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation; EA-13-090" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken; and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agency-wide Document Access Management System (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

Dated this 20th day of May 2013.

U.S. NUCLEAR REGULATORY COMMISSION  
REGION IV

Dockets: 05000275, 05000323, 07200026

Licenses: DPR-80, DPR-82, SNM-2511

Report Nos.: 05000275/2013008, 05000323/2013008, and 07200026/2013001

EA No. EA-13-090

Licensee: Pacific Gas and Electric Company (PG&E)

Facility: Diablo Canyon Power Plant Units 1, 2, and  
Independent Spent Fuel Storage Installation (ISFSI)

Location: 7.5 miles NW of Avila Beach  
Avila Beach, CA

Dates: April 2 - 4, 2013

Inspector: Lee Brookhart, Inspector, RIV RSFS

Accompanying  
Personnel: Eric Simpson, Inspector-in-Training, RIV RSFS

Approved By: D. Blair Spitzberg, Ph.D., Chief  
Repository & Spent Fuel Safety Branch  
Division of Nuclear Materials Safety

## EXECUTIVE SUMMARY

Diablo Canyon Power Plant  
NRC Inspection Report 05000275/2013008, 05000323/2013008, and 07200026/2013001

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine inspection of the licensee's programs and activities for safe handling and storage of spent fuel at the Diablo Canyon Independent Spent Fuel Storage Installation (ISFSI) on April 2 through April 4, 2013. The inspection reviewed a number of topics to evaluate compliance with the applicable NRC regulations and the provisions of its site specific license SMN-2511 which utilizes the Holtec HI-STORM 100 design. At the time of the inspection, 23 HI-STORM 100 Short Anchored (SA) casks were loaded and stored on the Diablo Canyon ISFSI pad. The casks were being maintained in good physical condition. Radiological dose rates around the ISFSI were low. A review of the environmental monitoring program demonstrated that radiological exposures to offsite locations were not occurring from the storage of the spent fuel at the ISFSI. Personnel exposures during cask loading were improving as Diablo Canyon continued its loading campaigns. The third and latest loading campaign doses were low and were comparable to doses typically seen during loading campaigns at the other Region IV sites. The quality assurance program and corrective action program were being effectively implemented to capture and correct issues related to the dry cask storage program.

The inspection reviewed documentation relevant to ISFSI activities and operations that have occurred at Diablo Canyon since the last ISFSI inspection that was performed in June of 2009, which observed the loading of Diablo Canyon's first cask. The documentation review included quality assurance, radiological conditions, corrective actions, compliance to technical specifications, compliance to Updated Final Safety Analysis Report (FSAR) requirements, and industry ISFSI issues that affected the site.

### Operation of an ISFSI at Operating Plants (60855.1)

- The licensee was conducting quality assurance audits of the ISFSI program. A review of four audit reports determined that the audits were covering a broad range of topics. A number of issues were identified in the audits and entered into the corrective action program for resolution. (Section 1.2.a)
- Radiation levels around the ISFSI pad were within expected ranges for a site with 23 casks in storage. For the environmental monitoring periods of 2009, 2010, and 2011, the dose from the ISFSI had no effect on dosimetry located between the ISFSI and the site boundary. (Section 1.2.b)
- Documents and records related to the 2009, 2010, and 2012 ISFSI cask loading campaigns were reviewed. Information included personnel dosimetry records, total personnel dose received per cask loading, and neutron doses received by workers during cask loading activities. Worker doses to load a cask have continued to decrease from previous loadings, with the last campaign averaging 0.121 person-rem/cask. (Section 1.2.c)
- Diablo Canyon was recording measurable neutron dose that ISFSI workers received during the loading campaigns through the use of the Panasonic UD-813 dosimeter. The Panasonic UD-813 dosimeters used for measuring personnel dose of legal record were



noted to have recorded doses which were statistically close to the data from the electronic alarming dosimeters worn by the workers for both gamma and neutron dose. (Section 1.2.d)

- Required records were maintained that described the specific fuel parameters for the spent fuel stored in each of the licensee's loaded casks. (Section 1.2.e)
- Since the last NRC ISFSI inspection Diablo Canyon has requested and NRC approved two license amendment changes and had revised the ISFSI FSAR twice in Revision 3 and Revision 4. No issues were identified in review of these changes. (Section 1.2.f)
- The FSAR does not include an accident analysis for a situation where the canister is filled with water after the lid is welded in place, with the vent and drain port caps closed, which resulted in an isolated condition. The licensee failed to perform an adequate safety review per 10 CFR 72.48 to ensure the Procedure HPP-1073-300 followed the process as outlined in Chapter 5 of the FSAR. Federal regulations in 10 CFR 72.48(c)(1) states, in part, that a licensee may make changes to procedures as described in the FSAR, if the change does not create a possibility for an accident of a different type than any previously evaluated in the FSAR. Contrary to this, the licensee failed to follow procedures as described in the FSAR and created a possibility for an accident not previously evaluated in the FSAR. This was determined by the NRC to be a Severity Level IV violation. The violation was cited in the Notice of Violation because Diablo Canyon was notified of a potential non-compliance in its procedure by the cask vendor (Holtec) and failed to restore compliance within a reasonable period of time, failed to place the issue in the corrective action program prior to the 2012 campaign, and proceeded to use the procedure that placed seven canisters in an unanalyzed condition from January 2012 through March 2012. (Section 1.2.g)
- Technical Specification 3.1.2 vent inspection requirements for the HI-STORMs were performed daily as required. (Section 1.2.h)
- Selected condition reports were reviewed for the period June 2009 through April 2013. A wide range of issues had been identified and resolved. Resolutions of the issues were appropriate for the safety significance of the issue. No adverse trends were identified during the review. (Section 1.2.i)
- Annual cask inspections had been completed in accordance with FSAR requirements. Only minor deficiencies were identified and placed in the corrective action program for resolution. (Section 1.2.j)
- Westinghouse identified an issue with CaskWorks, a program utilized by Diablo Canyon for analysis of its fuel assemblies' characteristics. The issue was placed in the corrective action program and appropriately resolved. (Section 1.2.k)
- Diablo Canyon's response to NRC Information Notice 2012-20 has been adequately captured and documented in the corrective action program. (Section 1.2.l)
- Diablo Canyon submitted its ISFSI Decommissioning Funding Plan in compliance with 10 CFR 72.30(b) on the submittal deadline of December 17, 2012. (Section 1.2.m)

#### Review of 10 CFR 72.48 Evaluations (60857)

- All required safety screenings and safety evaluations had been performed in accordance with procedures and 10 CFR 72.48 requirements except for the issue discussed in Section 1.2.g of this report. All other screenings and safety evaluations reviewed were determined to be adequately evaluated. (Section 2)

#### Followup (92701)

- Licensee Event Report Notification 47580, dated January 9, 2012 related to loose anchor stud nuts that were found on three loaded HI-STORMs. The licensee adequately addressed the condition and implemented appropriate corrective actions to prevent reoccurrence. (Section 3)

## Report Details

### Summary of Facility Status

Twenty three HI-STORM 100 Short Anchored (SA) storage casks each containing a 32 assembly Multi-Purpose Canister (MPC), were currently in storage at the Diablo Canyon ISFSI. Each MPC-32 canister holds 32 pressurized water reactor (PWR) spent fuel assemblies. The casks were being monitored in compliance with the thermal monitoring requirements of Technical Specification 3.1.2 and for radiation levels in compliance with 10 CFR Part 20 and 10 CFR Part 72 requirements. The casks were located inside a separate protected area outside the plant's 10 CFR Part 50 protected area. Diablo Canyon had loaded twenty two casks since the last NRC routine ISFSI inspection was performed in June 2009. A tour of the ISFSI area found the casks to be in good physical condition. Dosimeters located around the casks were providing radiological dose data within the expected levels for an ISFSI with 23 casks in storage. The ISFSI currently consists of two large concrete storage pads that can hold 20 anchored casks each. The ISFSI protected area was designed to hold a total of seven pads, each holding 20 anchored casks. Diablo Canyon plans to construct the remaining five pads in 2014. This would allow for a total capacity of 138 anchored casks with two slots left empty for shuffling purposes. The ISFSI casks were loaded using various SNM-2511 license amendments and FSAR revisions (see Attachment 2) but were all currently maintained under SNM-2511 License Amendment 2 and the FSAR, Revision 4.

The two reactors at Diablo Canyon are Westinghouse pressurized water reactors. A full core for each Westinghouse reactor consisted of 193 fuel assemblies. Refueling outages were performed approximately every 20 months for each reactor. Each refueling outage replaces approximately 88 assemblies in the core with new assemblies. A separate spent fuel pool was available for each reactor with sufficient room currently available for full core offload. The following table provides the current summary of the number of assemblies in the spent fuel pools and the available space.

	Unit 1	Unit 2
Spent Fuel Pool assembly capacity	1312	1309
Empty usable locations in the spent fuel pool	252	253

Diablo Canyon plans to load approximately six casks every two years starting in August 2013. The removing of 96 assemblies (3 casks) from each pool will more than offset the 88 new assemblies being added to the pools every 20 months due to a refueling outage. The cask with the highest heat load to-date held 20.29 kW.

## **1 Operations of an Independent Spent Fuel Storage Installation (ISFSI) at Operating Plants (60855.1)**

### **1.1 Inspection Scope**

An inspection of the status of the loaded casks at Diablo Canyon was completed to verify compliance with requirements of its SNM-2511 License, ISFSI FSAR, and federal regulations. The inspection reviewed a broad range of topics including audits and surveillances conducted by the licensee, condition reports related to the ISFSI and the fuel handling building crane, environmental radiological data collected around the ISFSI for the past several years, compliance with Technical Specification 3.1.2 for ventilation monitoring of the casks, review of the annual cask maintenance records, and review of

industry issues that affected the site's ISFSI program. A tour of the ISFSI area was performed and the inspectors observed radiation protection personnel take radiological dose rates measurements around the perimeter of the ISFSI pad and near the casks.

## 1.2 Observations and Findings

### a. Quality Assurance Audits and Surveillances

The Diablo Canyon Quality Verification Department had issued a number of audit reports between 2009 and 2013. Many of the audit reports involved ISFSI program related documentation, functions, and activities. Five audit reports were reviewed as part of the inspection: Quality Verification Short Form Assessment #092320031 - Special Nuclear Material Control, dated August 20, 2009; 2009 Technical Specification (TS) and Testing Audit, dated October 23, 2009; 2010 Quality Assurance Program Audit, dated July 10, 2010; 2011 Technical Specification Audit, dated October 5, 2011; and 2011 Fuel Management Program Audit, dated October 20, 2011.

The Short Form Assessment #092320031 identified fuel movement documentation issues that had the potential to impact the ISFSI's record keeping program. The problems identified were related to discrepancies in fuel bundle locations and fuel movement documentation. The 2009 Technical Specification and Testing Audit found minor errors and inaccuracies in Diablo Canyon ISFSI Technical Specification procedures and documents. The 2010 Quality Assurance (QA) Program Audit found some issues related to the Diablo Canyon ISFSI training program implementation. All issues that were identified through the audits were placed in the corrective action program and properly resolved.

In the 2011 Technical Specification Audit, the audit team assessed the applicability of an industry-wide FSAR issue related to the potential for pressure to build-up in a water-filled canister while isolated (for more discussion on this see Section 1.2.g).

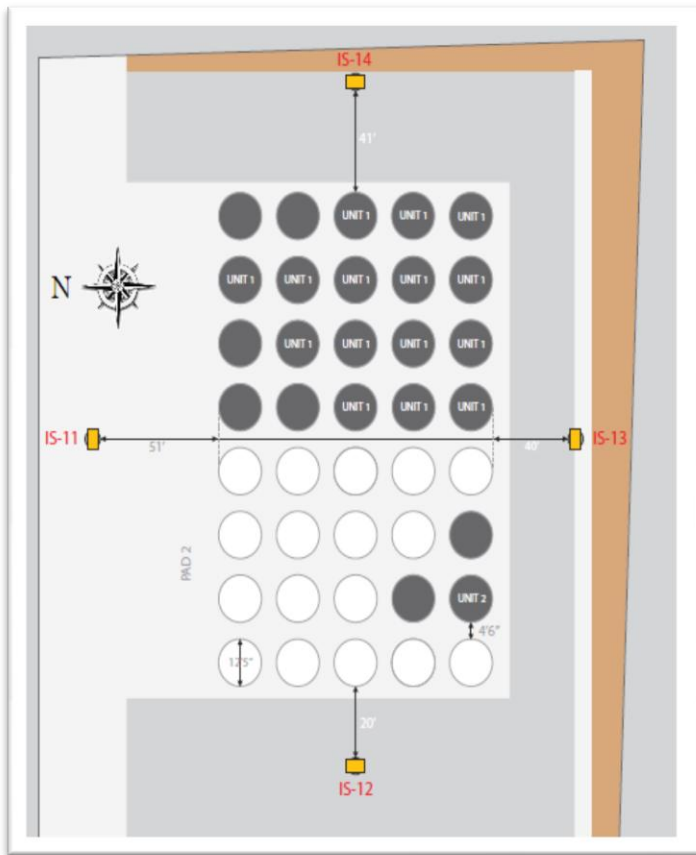
The 2011 Fuel Management Audit covered areas such as QA records related to fuel stored onsite in the dry cask storage system, ISFSI program and licensing requirements, design control, operation, maintenance, and training. The audit team looked at the ISFSI records and verified, by random sample, that they were readily retrievable from the Records Management System and completed in accordance with plant standards. The QA records were determined to be satisfactory. The audit documented that combustible material was found stored inside the ISFSI fence, despite the outer ISFSI fence being posted as a "no combustible items storage area." This issue was entered into the Diablo Canyon corrective action program under SAPN #50423487 and the container was removed from inside the ISFSI fence.

### b. Radiological Conditions Related to Stored Casks

A tour of the ISFSI pad was performed during the inspection. The tour found the 23 loaded HI-STORM casks to be in good condition. No flammable or combustible materials were observed inside the ISFSI protected area. A recent radiological survey of the ISFSI pad was provided to NRC inspectors prior to their arrival on-site. Two radiation protection (RP) technicians accompanied the NRC inspectors during the pad tour. A radiological survey was performed by the RP technician with a neutron sensitive remball and an ion chamber for gamma radiation. A low-range gamma sensitive detector was

provided to the NRC inspectors. General area background readings before reaching the ISFSI were zero mrem/hr neutron and 13  $\mu$ R/hr gamma. Survey measurements were taken around the ISFSI pad, at selected cask lower vent locations, and at environmental thermo luminescent (TLD) monitoring locations inside the ISFSI protected area fence. At the time of the inspection ISFSI pad 1 located in the most eastern part of the ISFSI fenced area contained 20 casks. ISFSI pad 2 contained three casks and pads 3-7 had not been built. Pads 3-7 would lie to the west of pad 2, which contained three casks (see Figure 1).

The observed general exposure rates at the edge of the ISFSI pad 1 and 2 ranged from 135 to 1000  $\mu$ R/hr (0.135 to 1.0 mR/hr) gamma and less than 0.2 mrem/hr neutron. Radiation levels measured at a few casks' lower vent locations were 1.25 to 2.0 mR/hr gamma and 1.6 to 2 mrem/hr neutron. The survey measurements confirmed the measurements recorded on the survey that was provided earlier to NRC by the licensee.



There were four TLD monitoring locations around the ISFSI pad that were responsible for measuring the direct radiological impact from the loaded casks (see graphic inset on left). Those monitoring locations were identified by the Radiological Environmental Monitoring Program (REMP) as: IS-11, a monitoring location to the north of the pad, along the centerline of pad 1 and pad 2, and at a distance of 51 feet north of the pad; IS-12, a monitoring location centrally located directly west of pad 2, at distance of 20 feet; IS-13, a monitoring location to the south of the pad, along the centerline of pad 1 and pad 2, and at a distance of 40 feet from the pad; and IS-14, a monitoring location centrally located directly east of pad 1 and at a distance of 41 feet.

**Figure 1 Diablo Canyon ISFSI Pad Orientation**

The TLDs used at the four monitoring locations within the ISFSI fence were Panasonic UD-813 dosimeters that monitor both gamma and neutron dose rates. Each of the four monitoring locations included a TLD that was mounted on the outside of a monitoring phantom. The phantom, a human tissue equivalent box, assisted the TLD in recording both direct incident and back-scattered neutron dose. The phantom mimics the actual dose response that a human would receive.

The gamma exposure rates measured during the NRC walk down at the monitoring locations were: 110 µR/hr at IS-11; 60 µR/hr at IS-12; 173 µR/hr at IS-13; and 140 µR/hr at IS-14. The measured dose rates at those locations were comparable to the annual gamma TLD monitoring data provide in Table 1. The neutron percentage of the total dose represented in the Table 1 by the Δ% column, ranged from 9 to 17 percent depending on the monitoring location.

**Table 1, ISFSI Pad TLD Monitoring Annual Total Gamma & Neutron Dose in mrem**

Loc.	2010			2011			2012			Average
	Neutron	Total	Δ %	Neutron	Total	Δ %	Neutron	Total	Δ %	
IS-11	39	446	9 %	62	510	12%	99	650	15%	535
IS-12	53	588	9 %	60	581	10%	131	776	17%	648
IS-13	132	1421	9 %	149	1374	10%	156	1505	10%	1433
IS14	130	1231	11%	127	1111	11%	157	1195	13%	1179

Offsite and onsite monitoring data from the 2009, 2010, and 2011 Diablo Canyon Annual Radiological Environmental Operating Reports (REOPs) were reviewed (Adams Accession No. ML101260133, ML11129A085, ML11129A086, ML11129A087, ML12128A479, ML1215A382, ML1215A383, ML12125A384, ML12125A386, and ML1215A387). Those reports were generated by the Diablo Canyon’s Radiological Environmental Monitoring Program (REMP) group. As part of the program, Diablo Canyon placed eight environmental TLD monitoring locations just outside the ISFSI fence to monitor the radiological impacts of the ISFSI. The TLDs used for those locations were the Panasonic UD-814 model which measure only gamma doses.

Annual dose data for the eight TLDs located just outside the ISFSI fence, surrounding the ISFSI are shown in Table 2. The TLDs outside the ISFSI fence started to record higher annual doses after the licensee began loading casks in late 2009. The TLD locations with higher readings were locations that were closer to ISFSI pads 1 and 2 that held the loaded casks at the ISFSI.

**Table 2, Annual Doses in mrem, outside the ISFSI Fence Monitoring Locations**

TLD Identifier	2009 Total	2010 Total	2011 Total
IS-1	93.0	92.2	94.3
IS-2	94.6	96.6	99.6
IS-3	111.1	133.0	143.1
IS-4	166.3	286.5	305.1
IS-5	143.2	252.4	291.3
IS-6	126.0	186.6	214.2
IS-7	106.0	142.8	150.9
IS-8	83.1	83.1	87.1

Other TLDs of interested from the operating report included six TLDs that surrounded the ISFSI at a distance of approximately 0.2 miles to 0.4 miles away. These TLDs lied in between the ISFSI and Diablo Canyon’s property boundary. Those TLDs in Table 3, remained statistically constant despite the cask loading campaigns that were perform during 2009 through 2011.

**Table 3, Annual Doses for Locations Between the ISFSI and the Site Boundary**

TLD Identifier	2009 Total	2010 Total	2011 Total
2S1, West of the ISFSI	66.6	63.5	67.4
3S1, NW of the ISFSI	82.0	81.3	81.7
4S1, North of the ISFSI	80.5	80.5	80.5
5S3, NE of the ISFSI	76.4	74.2	75.4
6S1, East of the ISFSI	54.4	53.0	53.4
7S1, South of the ISFSI	74.4	73.7	79.4

For the monitoring periods of 2009, 2010, and 2011, the dose from the ISFSI had no effect on dosimetry located between the ISFSI and the site boundary.

c. Radiological Information Related to Cask Loading

Documents and records related to the 2009, 2010, and 2012 cask loading campaigns were provided by the radiation protection (RP) staff and reviewed. The dose received during each cask's loading was broken-down into functional activities of where the dose was acquired. Those functional areas were: project management (PM), mechanical and maintenance (M&M), radiation protection (RP), decontamination (DECON), operations (OPS), and in-service Inspection (ISI) for the 2009 loading campaign (See Table 4, below).

**Table 4, 2009 ISFSI Loading Campaign Personnel Total Doses (neutron and gamma) per ISFSI Program Area and Cask in mrem**

	MPC-30	MPC-12	MPC-10	MPC-14	MPC-17	MPC-21	MPC-65	MPC-8
<b>PM</b>	241	184	234	179	180	164	137	125
<b>M&amp;M</b>	33	27	21	24	35	36	31	24
<b>RP</b>	69	44	39	25	22	22	15	9
<b>DECON</b>	15	13	15	11	10	11	11	9
<b>OPS</b>	11	6	7	6	6	6	2	2
<b>ISI</b>	1	0	0	0	0	0	0	0
<b>Total</b>	370	274	316	245	253	239	196	169

The doses during the first campaign tended to be highest for the program management, mechanical and maintenance, and radiation protection areas. The radiological doses tended to improved with each subsequent cask during the 2009 campaign.

During the 2010 and the 2012 loading campaigns at Diablo Canyon the RP program added three additional groupings for dose tracking. Those activity areas included: Holtec, an activity to track the doses of the Holtec crew that performed a majority of the loading operations; PCI, an activity that that tracked doses to the welders and welding non-destructive examination (NDE) specialists; and Bragg, an activity that tracked the doses associated with a local crane rigging outfit that assisted during cask movements while at the cask transfer facility near the ISFSI pad (see Table 5 and Table 6).

**Table 5, 2010 ISFSI Loading Campaign Personnel Total Doses (neutron and gamma) per ISFSI Program Area and Cask in mrem**

	MPC-127	MPC-123	MPC-126	MPC-121	MPC-124	MPC-120	MPC-125	MPC-122
<b>Holtec</b>	175	165	95	73	68	74	51	80

	MPC-127	MPC-123	MPC-126	MPC-121	MPC-124	MPC-120	MPC-125	MPC-122
PCI	70	44	30	24	23	26	21	21
Bragg	34	48	15	14	11	18	12	13
PM	1	0	0	0	0	1	0	0
MM	35	23	25	15	17	20	19	15
RP	52	23	24	18	13	10	14	7
DECON	32	12	7	10	7	4	5	4
OPS	0	4	3	7	0	0	0	0
ISI	0	0	0	0	0	0	0	0
<b>Total</b>	399	319	199	161	139	153	122	140

Comparing the 2009 to the 2010 and 2012 loading campaigns, the vast majority of dose that was assigned to program management during the first campaign moved to the Holtec group. The doses associated with mechanical & maintenance remained statistically similar, while the PCI workers accumulated the second highest dose during the 2010 cask loading campaign. Generally, the mrem per cask tended to trend downward with each subsequent cask during the 2010 campaign. By the 2012 campaign, the mrem per cask average was 121 mrem/cask, which is comparable to other region IV sites that use the Holtec HI-STORM 100 design.

**Table 6, 2012 ISFSI Loading Campaign Personnel Total Doses (neutron and gamma) per ISFSI Program Area and Cask in mrem**

	MPC-168	MPC-167	MPC-169	MPC-166	MPC-170	MPC-165	MPC-173
Holtec	75	62	47	34	68	67	54
PCI	12	16	14	6	9	14	14
Bragg	24	7	7	9	11	10	12
PM	5	3	2	2	5	3	4
MM	13	8	6	6	12	12	12
RP	18	7	12	7	9	13	14
DECON	20	8	16	8	22	15	19
OPS	0	0	0	3	0	0	0
ISI	0	0	0	0	0	0	0
<b>Total</b>	157	111	104	75	136	134	129

d. Neutron Monitoring

Three dosimeters were in active use at Diablo Canyon: the Panasonic UD-802, Panasonic UD-813, and Panasonic UD-814. The Panasonic UD-802 is the primary dosimeter used to measure personnel dose of legal record (DLR) for the majority of monitored personnel onsite. The Panasonic UD-802 is a neutron sensitive TLD, but it was not optimized and utilized for neutron sensitive activities at Diablo Canyon. The Panasonic UD-813 dosimeter was a custom designed dosimeter used at Diablo Canyon for ISFSI related personnel monitoring and as an environmental TLD on the ISFSI pad. The Panasonic UD-813 was a four-element TLD that had sundry filters on the front and back of its holder. The front and rear filters were situated such that it measured neutrons incident from both the front and rear of the badge when in use. The rear filters were intended to record the albedo effect from the neutron dose. The albedo effect is related to the reflection of incident neutrons off of the body of a monitored individual. The Panasonic UD-814 is a dosimeter that is used by the RP staff to measure the radiological environmental dose at both onsite and offsite locations. The Panasonic UD-814 dosimeter was configured to measure gamma dose only.

In addition to the Panasonic UD-813 dosimeter used during loading activities, an



electronic gamma/neutron dosimeter with a digital output was used by workers for dose estimation and tracking purposes. The gamma and neutron doses reported by the

electronic dosimeters during the loading campaigns tracked statistically close with the gamma and neutron doses reported by the Panasonic UD-813 dosimeter.

Diablo Canyon processed the site's personnel and environmental dosimetry. By processing the dosimetry, Diablo Canyon had more control over the quality of its TLD measurements. Based on interviews with dosimetry staff, Diablo Canyon managed to control neutron doses to a lower threshold keeping the lower limits of detection for neutron dose to within the range of 5-8 mrem.

The dosimetry records for the personnel associated with the 2010 cask loading activities was reviewed to see how neutron doses compared to gamma and total doses. During the 2010 ISFSI loading campaign total doses received by personnel was 531 mrem gamma and 423 mrem neutron. For the 2010 loading campaign neutron dose accounted for 44 percent of the total dose reported.

A review of PCI (welders and NDE staff) dose data for the 2010 loading campaign showed that the dose tracked using the electronic dosimeters for gamma and neutron correlated well with the dose reported by the Panasonic UD-813 dosimeter used for the dose of legal record. The electronic dosimeters in use slightly overestimated the gamma dose received by 8 percent and neutron dose received by 16 percent. The electronic dosimetry reported a total dose of 106 mrem gamma and 153.6 mrem neutron to the PCI personnel during the 2010 campaign. The actual dose recorded on the dose of legal record for the PCI crew, tracked by the Panasonic UD-813 dosimeter, recorded 98 mrem gamma and 132 mrem neutron.

e. Cask Records of Fuel Contents

A review of the Diablo Canyon ISFSI records was performed to determine if an adequate description of the spent fuel loaded in the Holtec HI-STORM 100SA casks was documented in the licensee's records. The contents of each multi-purpose canister (MPC) loaded into a HI-STORM 100SA cask at Diablo Canyon was documented in DCP Form 69-20428 Design Calculation Numbers: 9000040833, 9000041030, 9000041317, and number unassigned. These calculations had not yet received final signoff, and were due to errors found in the CaskWorks program which is discussed in Section 1.2.k of this report. The calculations contained fuel bundle specifications including fuel type, decay heat, cooling time, initial U-235 enrichment, and burnup values for each spent fuel bundle loaded into a canister at Diablo Canyon. Forms were reviewed for all 23 loaded casks at the time of the inspection. The quality verification program had also reviewed a random sample of these records in its 2011 Fuel Management Audit, issued October 20, 2011 (see Section 1.2.a) and found that the records were readily retrievable and complete.

f. Changes to the SNM-2511 License and FSAR

At the time of the last inspection in June of 2009, Diablo Canyon was utilizing SNM-2511 License Amendment 0 and FSAR Revision 2. Since then, Diablo Canyon has requested and NRC approved two license amendment changes. The licensee has also revised the FSAR twice in Revision 3 and Revision 4.

Amendment 1 to Diablo Canyon's SNM-2511 License was approved by the NRC on February 10, 2010 (ADAMS Accession Number ML100360010). The major changes associated with the amendment included: (1) Technical specification (TS) 3.1.4 was removed from the license. TS 3.1.4 originally contained a time limit that prevented a HI-STORM cask from being left in the cask transfer facility (CTF). The NRC reviewed the supporting thermal analysis that was performed to remove TS 3.1.4 and concluded the removal was acceptable since the fuel cladding temperature limits would not be exceeded if left in the CTF; (2) TS 3.2.1 was changed to allow the use of linear interpolation for determining the soluble boron concentration during loading operations. Previously only two defined levels were defined in the TS; and (3) TS 3.1.1 helium leak test was changed to be performed only on the vent/drain port cover plate welds vice the lid weld and the vent/drain port cover welds. This was to provide consistency with the leak rate testing requirements of Holtec's generic Certification of Compliance 1014, Amendment 3.

Amendment 2 to Diablo Canyon's SNM-2511 License was approved by the NRC on January 19, 2012 (ADAMS Accession Number ML120260361). The major changes associated with the amendment included: (1) the vacuum drying method was removed from TS 3.1.1. Diablo Canyon only utilized the forced helium dehydration method for drying canisters; (2) TS 3.1.4 "Supplemental Cooling System" was added to allow loading of high burn-up fuel (fuel assemblies > 45,000 MWd/MTU); (3) TS 2.0 "Approved Contents" was revised to reflect the addition of high burn-up fuel and a maximum decay heat load for a MPC-32 canister to 750 Watts per assembly for a canister containing high burn-up fuel; and (4) TS 2.0 "Approved Contents" was changed to allow the storage of fuel assemblies with instrument tube tie rods and neutron source assemblies.

The two FSAR changes, Revision 3 and Revision 4, were performed to account for the new license amendments that were reviewed and approved by the NRC in Amendments 1 and 2, respectively.

g. Isolation of Loaded Canisters, Holtec Information Bulletin (HIB) – 53

Holtec Information Bulletin HIB-53 was issued to the Holtec users on December 6, 2011. The bulletin described an issue that was observed by NRC inspectors at the Waterford nuclear plant (ADAMS Accession ML12124A387). While Waterford was loading its first canister in late November 2011, operators isolated the canister by closing both the vent and drain port caps during installation of the removable valve operating assemblies (RVOAs). Having both port caps closed at the same time isolated the canister without having any release path or relief valve available while the canister was filled with water and fuel. This could have pressurized the canister due to the thermal heat of the spent fuel. The Holtec bulletin reminded users that the vent and drain port caps should not be closed simultaneously and that the remote valve operating assemblies must be installed one at a time in the open position when the canister is filled with water. Holtec Information Bulletin 53, under "Urgency Level," the bulletin stated "Users who are currently in the process of loading should ensure the guidance in this document is followed when processing the MPC. For those users who are not currently in the process of loading, updates should be made to their procedures, if required based on this guidance before the next loading."

In addition to HIB-53, issued in December 2011, prior to the 2012 loading campaign, the licensee's Quality Assurance (QA) organization had also identified this issue in a Quality Verification Department audit of the Diablo Canyon Power Plant Technical Specification Program conducted from July 6 through September 6, 2011. This audit was documented in Memorandum File Net # 111800033 titled "2011 Technical Specification Audit," dated October 5, 2011. However, no action was taken at that time to determine whether the loading procedures could result in isolation of a loaded cask while containing water. Diablo Canyon's quality assurance audit documented that "the Holtec canister design does not have an isolation valve that could defeat pressure relief and create the potential for over-pressure." This assessment did not address the use of the port caps to cause an isolation event.

On March 19, 2013, the licensee became aware a third time of the Holtec bulletin to ensure isolation of the canister would not occur during loading operations when the NRC inspector emailed Diablo Canyon a list of topical areas that would be included in the April 2013 ISFSI inspection. This list specifically referred to HIB-53. Upon receiving the list of inspection items, the licensee reviewed HIB-53 and realized that no action had been taken after receiving the bulletin in December 2011, over a year earlier and prior to loading seven canisters during the 2012 loading campaign. The licensee placed the missed opportunity to correct its loading procedures into the corrective action program as SAPN 50466943 Task #7 on March 21, 2013.

The Diablo Canyon Procedure HPP-1073-300 "Procedure for Drying, Backfill, and Sealing the MPC at DCP," Revision 9 dated October 28, 2011 was not updated to comply with the HIB-53 prior to Diablo Canyon's third loading campaign which loaded seven casks from January 24, 2012 through March 17, 2012. Procedure HPP-1073-300 Step 6.3.2 directed personnel to install the MPC lid drain/vent port caps by verifying each of the caps were fully seated. This step resulted in the canister being in an isolated condition. At that time, the canister lid had been installed and welded and the canister was filled with water except for the approximately 50 gallons that was removed prior to welding of the lid. As long as the vent and drain port caps were fully seated there was no pressure relief valve in line to provide for over-pressurization relief. The procedure relieved this situation in Step 6.3.19 after the drain port removable valve operator assembly (RVOA) was installed over the drain port cap and the operating rod was used to open the drain port and provide a vent to the canister. The estimated time period a canister was in an isolated condition has been approximated to about forty to sixty minutes. Since the isolation period was of short duration the resulting pressure increase inside the canister would have been low.

A review of Diablo Canyon's FSAR found no discussion of isolating the canister during operations or any accident analysis that evaluated buildup of pressure in the canister during isolation due to the heating effect of the spent fuel on the water inside the canister. FSAR Section 8.2.14.2 "Accident Analysis" discussed a hypothetical event of the failure of all the fuel rods during storage/transportation. In this condition no water was in the canister and the pressure build-up was due to the pressure that had escaped from inside the fuel rods. This resulted in a maximum pressure of 166.1 psig for a MPC-32 canister containing PWR fuel with a 24 kW total heat load. This was identified as being less than the MPC accident design pressure of 200 psig.

Buildup of pressure inside the canister due to heating of the water by the spent fuel while the canister is isolated is not analyzed in the Diablo Canyon ISFSI FSAR. Following Procedure HPP-1073-300 Step 6.3.2 through Step 6.3.19 resulted in a period of time that the canister was isolated. The FSAR, Chapter 5 "ISFSI Operations" describes the operations for loading a cask. These steps do not place the canister in an isolated condition with water still in the canister. The licensee failed to perform an adequate safety review per 10 CFR 72.48 to ensure the Procedure HPP-1073-300 followed the procedures as outlined in Chapter 5 of the FSAR.

Federal regulations in 10 CFR 72.48(c)(1) and (c)(2)(v) states that a licensee may make changes in the facility or spent fuel storage cask design as described in the FSAR, make changes to procedures as described in the FSAR, and conduct tests or experiments not described in the FSAR without obtaining a license amendment if the change, test, or experiment does not create a possibility for an accident of a different type than any previously evaluated in the FSAR.

Contrary to the above requirement, from late January 2012 through March 2012, the licensee failed to follow procedures as described in the FSAR and created a possibility for an accident not previously evaluated in the FSAR, without obtaining a license amendment change. Specifically, Diablo Canyon's , Procedure HPP-1073-300 included steps that were not consistent with Chapter 5 of the FSAR and resulted in the isolation of the canister, while filled with water, which created the possibility of an accident not evaluated in Chapter 8 of the FSAR. Diablo Canyon used this procedure to load seven casks from January 2012 to March 2012. This was determined by the NRC as a Severity Level IV violation in accordance with the guidance set forth in Section 2.2.2 of the Enforcement Policy. The violation is being cited in the Notice because Diablo Canyon was notified of a potential non-compliance in its procedure by the cask vendor (Holtec), failed to restore compliance within a reasonable period of time, failed to place the issue in the corrective action program in a timely manner before the 2012 campaign, and proceeded to use the procedure that placed seven canisters from January 2012 through March 2012 in an unanalyzed condition.

On April 24, 2013, Diablo Canyon issued Licensee Event Report Notification 48965 that documented that their loading procedures had placed canisters in an isolated condition which was not analyzed in the Diablo Canyon FSAR.

h. Technical Specification 3.1.2 Temperature Monitoring

Technical Specification 3.1.2 required each cask's heat removal system to be operable during storage on the ISFSI pad. Surveillance Requirement 3.1.2.1 required the licensee to verify daily the inlet and outlet duct screens are free of blockage. The licensee utilized Procedure STP I-1A "Routine Shift Checks Required by Licenses," Revision 125 to comply with the Technical Specification. The Procedure STP I-1A Attachment 12.1 "MODE 1 Shift Checklist" required operators to verify all inlets and outlets for each cask loaded on the ISFSI pad was free of blockage.

Documentation was reviewed for the months of September 2010, December 2011, February 2012, and July 2012 for compliance with Technical Specification 3.1.2. Of the four months selected for review, the licensee provided documentation that showed the casks were verified as operable and free from blockage.

i. Corrective Action Program

A list of condition reports issued since the last NRC inspection in June of 2009 was provided by the licensee for the fuel handling building crane and the ISFSI. Issues were processed in accordance with Procedure OM7.ID1 "Problem Identification and Resolution," Revision 42. When a problem was identified the licensee would document the issue as a condition report in the Systems Application and Process Notification (SAPN) database and assign a SAPN number to track the issue.

Of the list of condition reports (SAPNs) provided relating to the ISFSI and the fuel handling building crane, approximately 50 SAPNs were selected by the NRC for further review. The SAPNs related to a number of different topics including: failure of a wedgelock assembly on the tower of the Vertical Cask Transporter during loading operations, forced helium dehydrator skid failure during loading operations, the canister downloader slings were discovered damaged and were sent to the manufacturer for repair/recertification, fuel handling building crane troubleshooting, issues discovered by Westinghouse related to the CaskWorks program, a hydraulic pump on the Vertical Cask Transporter failed, paint flaking off the HI-TRAC transfer cask, small cracks found on non-structural welds of the Vertical Cask Transporter, loading problems identified during the 2<sup>nd</sup> loading campaign, crew ALARA dose goals were not met for Cask # 9, and issues regarding loose HI-STORM hold-down nuts found on the ISFSI pad.

The SAPNs reviewed were well documented and properly categorized based on the significance of the issue. The corrective actions taken were appropriate for the situations. Based on the level and detail of the corrective action reports, the licensee demonstrated a high attention to detail in regards to the maintenance and operation of their ISFSI program and fuel handling building crane. The high number of SAPNs and the SAPN issues reviewed by the inspectors reflected a low threshold to place issues in the corrective action program. No NRC concerns were identified related to the condition reports reviewed.

j. Annual Inspections of the HI-STORM Casks

The Diablo Canyon ISFSI FSAR Section 4.2.3.1 "Function" states the maintenance programs of the HI-STORM 100 System are specified in Chapter 9 of the HI-STORM 100 FSAR. The Holtec HI-STORM 100 FSAR Chapter 9 Table 9.2.1 "HI-STORM System Maintenance Program Schedule" required users to perform an annual inspection of each casks external surface on an annual basis. Diablo Canyon utilized Procedure PEP DF-12 "HI-STORM Annual Inspection" Revision 1 to perform the annual inspection of the casks loaded on the ISFSI pad. The NRC Inspectors reviewed the inspection documentation for years 2011 and 2012. The 2011 annual inspection was documented Work Order No. 64057344, dated September 29, 2011 and the 2012 annual inspection was documented in Work Order No. 64079851, dated October 1, 2012. All issues that were identified during the inspection, such as, anchor bolt corrosion, cask coating repairs, and other miscellaneous items were placed in the licensee's corrective action program for resolution. All deficiencies identified were minor and did not affect the function of the casks to perform their safety function.

k. CastWorks Provided Non-Conservative Decay Heat Values

On January 18, 2012, Diablo Canyon received an email from Westinghouse, the vendor of CaskWorks that discussed a generic issue. Diablo Canyon utilized Westinghouse's program, CaskWorks, to evaluate fuel assembly characteristics, such as burnup and decay heat for compliance to with their License's Technical Specifications. Westinghouse revealed in the email that certain program files used for calculating a fuel assembly's decay heat referenced Boiling Water Reactor (BWR) fuel assembly values in the program code instead of PWR fuel assembly values. Diablo Canyon was one of the sites listed in the email that was affected by this discrepancy. The program code issue resulted in non-conservative decay heat values that could be off by as much as 2 percent from the correct value. The email then described how Westinghouse would correct the program code for all users that were affected.

Upon receiving the email, Diablo Canyon issued condition report SAPN 50453662 dated January 23, 2012 to address the discrepancy. In the SAPN Diablo Canyon documented that per ISFSI FSAR Section 3.1.1.2 "Thermal and Radiological Characteristics," Diablo Canyon already applied a 5 percent conservative burnup uncertainty when calculating the decay heat for a fuel assembly loaded in a canister. Since the notification from Westinghouse stated the difference in decay heat was expected to be less than 2 percent, Diablo Canyon's conservative calculation would still be higher than the actual decay heat, ensuring no limits were exceeded. To maintain compliance with the FSAR Section 3.1.1.2, the licensee was in the process of recalculating the decay heat values of all assemblies loaded into the 23 HI-STORM casks to still include the 5 percent conservatism. This action was being tracked by SAPN 50453662. Inspectors reviewed the latest calculations, DCP Form 69-20428 Design Calculation Numbers: 9000040833, 9000041030, 9000041317, and number unassigned, which determined the new decay heat values for each assembly and cask. These calculations had not yet received final approval. No individual fuel assembly or total cask heat load values exceeded the technical specifications with the 2 percent increase.

l. Decommission Funding Plan

Federal Register Notice 76FR35512, dated June 17, 2011, included a new rulemaking requirement that affected Part 72 licensees. The Federal Register documented a change to 72.30(b) which required Part 72 licensees to submit to the NRC for review and approval an ISFSI decommissioning funding plan. The final rule made changes to the financial assurance requirements for Part 72 licensees to provide greater consistency with similar decommissioning requirements in the 10 CFR Part 50 regulations. Financial assurances are financial arrangements provided by the licensee to ensure funds for decommissioning will be available when needed. The effective date of the new rule was December 17, 2012. The new rule required all Part 72 licensees to submit a decommissioning funding plan to the NRC by the effective date of the rule. Diablo Canyon submitted its ISFSI Decommissioning Funding Plan to the NRC for review and approval on December 17, 2012 (Adams Accession No. ML12353A315) in compliance with the new rule.

m. NRC Information Notice 2012-20

On November 14, 2012, NRC issued Information Notice 2012-20, Potential Chloride-Induced Stress Corrosion Cracking of Austenitic Stainless Steel and Maintenance of Dry Cask Storage System Canisters, to all holders of and applicants for an ISFSI license or

Certificate of Compliance under 10 CFR Part 72. The notice required no action, but discussed the occurrence of chloride induced stress corrosion cracking in stainless steel welds on various piping components at four nuclear sites within a close proximity to salt water bodies. Those sites were San Onofre Nuclear Generating Station, St. Lucie Nuclear Power Plant, Turkey Point Nuclear Generating Station, and Koeberg Nuclear Power Station (South Africa).

The Information Notice discussed the stress corrosion cracking failures that have been documented thus far at nuclear facilities and the environmental and chemical conditions that contribute to the failures. Since the storage canisters use the same types of stainless steel and welding materials as the piping that was found to contain stress corrosion cracking, the IN provided information specific to ISFSI sites on the conditions that have lead to those failures. The notice documented that no instances of stress corrosion cracking have been reported on spent fuel canisters by the industry or the NRC.

Diablo Canyon received the Information Notice and entered it into the corrective action program by issuing SAPN 50525427 on November 27, 2012. The SAPN 50525427 discussed how Diablo Canyon and the nuclear industry as a whole has been aware of the stress corrosion cracking issues and how they support research into the cause of the problem and the development of a comprehensive plan to address the issue. After completion of the research and development, Diablo Canyon planned on developing an appropriate aging management plan to address stress corrosion cracking on canisters at the site.

Diablo Canyon's response to NRC Information Notice 2012-20 has been adequately captured and documented in the corrective action program.

### 1.3 Conclusions

The licensee was conducting quality assurance audits of the ISFSI program. A review of four audit reports determined that the audits were covering a broad range of topics. A number of issues were identified in the audits and entered into the corrective action program for resolution.

Radiation levels around the ISFSI pad were within expected ranges for a site with 23 casks in storage. For the environmental monitoring periods of 2009, 2010, and 2011, the dose from the ISFSI had no effect on dosimetry located between the ISFSI and the site boundary.

Documents and records related to the 2009, 2010, and 2012 ISFSI cask loading campaigns were reviewed. Information included personnel dosimetry records, total personnel dose received per cask loading, and neutron doses received by workers during cask loading activities. Worker doses to load a cask have continued to decrease from previous loadings, with the last campaign averaging 0.121 person-rem/cask.

Diablo Canyon was recording measurable neutron dose that ISFSI workers received during the loading campaigns through the use of the Panasonic UD-813 dosimeter. The Panasonic UD-813 dosimeters used for measuring personnel dose of legal record were noted to have recorded doses which were statistically close to the data from the electronic alarming dosimeters worn by the workers for both gamma and neutron dose.



Required records were maintained that described the specific fuel parameters for the spent fuel stored in each of the licensee's loaded casks.

Since the last NRC ISFSI inspection Diablo Canyon has requested and NRC approved two license amendment changes and had revised the ISFSI FSAR twice in Revision 3 and Revision 4. No issues were identified in review of these changes.

The FSAR does not include an accident analysis for a situation where the canister is filled with water after the lid is welded in place, with the vent and drain port caps closed, which resulted in an isolated condition. The licensee failed to perform an adequate safety review per 10 CFR 72.48 to ensure the Procedure HPP-1073-300 followed the process as outlined in Chapter 5 of the FSAR. Federal regulations in 10 CFR 72.48(c)(1) states, in part, that a licensee may make changes to procedures as described in the FSAR, if the change does not create a possibility for an accident of a different type than any previously evaluated in the FSAR. Contrary to this, the licensee failed to follow procedures as described in the FSAR and created a possibility for an accident not previously evaluated in the FSAR. This was determined by the NRC to be a Severity Level IV violation. The violation was cited in the Notice of Violation because Diablo Canyon was notified of a potential non-compliance in its procedure by the cask vendor (Holtec) and failed to restore compliance within a reasonable period of time, failed to place the issue in the corrective action program prior to the 2012 campaign, and proceeded to use the procedure that placed seven canisters in an unanalyzed condition from January 2012 through March 2012.

Technical Specification 3.1.2 vent inspection requirements for the HI-STORMs were performed daily as required.

Selected condition reports were reviewed for the period June 2009 through April 2013. A wide range of issues had been identified and resolved. Resolutions of the issues were appropriate for the safety significance of the issue. No adverse trends were identified during the review.

Annual cask inspections had been completed in accordance with FSAR requirements. Only minor deficiencies were identified and placed in the corrective action program for resolution.

Westinghouse identified an issue with CaskWorks, a program utilized by Diablo Canyon for analysis of the fuel assemblies' characteristics. The issue was placed in the corrective action program and appropriately resolved.

Diablo Canyon's response to NRC Information Notice 2012-20 has been adequately captured and documented in the corrective action program.

Diablo Canyon submitted its ISFSI Decommissioning Funding Plan in compliance with 10 CFR 72.30(b) on the submittal deadline of December 17, 2012.

## **2 Review of 10 CFR 72.48 Evaluations (60857)**

### **2.1 Inspection Scope**

The licensee's 10 CFR 72.48 screenings and evaluations since the 2009 NRC ISFSI inspection were reviewed to determine compliance with regulatory requirements.

### **2.2 Observations and Findings**

A list of modifications to the ISFSI program and changes to the fuel handling building crane were provided by the licensee. Five 10 CFR 72.48 screenings were selected for further review and four 72.48 full evaluations were selected for review. The licensee utilized Procedure TS3.ID2 "Licensing Basis Impact Evaluations," Revision 34A to perform the 10 CFR 72.48/50.59 safety screenings or evaluations. The issues discussed in the screenings selected for review included the following: revision and addition of design output documents from Holtec; the correction of inconsistencies in the FSAR; changes made to the FSAR that were approved by the NRC in License Amendments 1 and 2; and the allowance for a MPC to be placed 90 degrees from the normal orientation in a HI-STORM.

The four 72.48 Evaluations that had been performed since the last inspection were reviewed. All four of the evaluations were reported to the NRC in PG&E letter DIL-12-002 "Materials License No. SNM-2511, Docket No. 72-26 Diablo Canyon ISFSI 10 CFR 72.48 Report of Changes, Tests, and Experiments for March 1, 2010 to February 29, 2012," dated March 15, 2012 (Adams Accession Number ML12075A077). Each of the following safety evaluations documented that the proposed change did not require NRC approval.

Safety evaluation Licensing Basis Impact Evaluation (LBIE) 2010-004 dated April 26, 2010, documented an upgrade to the vertical cask transporter. The upgrade redesigned the wedge assemblies located in the lift towers which lock the towers in case of a power failure. The new design was spring-engaged like the existing design but was released with hydraulic versus electromechanical force. Also the display system was upgraded to a new digital control system that contained enhanced features.

Safety Evaluation LBIE 2010-006 dated May 1, 2010, documented the addition of shim plate weldments onto the bottom of the storage cask's base-plate to ensure flatness of the matting contact surface with the ISFSI pad and changes in the thread size of the storage cask's lid anchor block to accommodate the thickness of an applied coating that reduced bolt binding.

Safety Evaluation LBIE 2010-010 dated June 24, 2010, documented non-conformances on HI-STORM casks serial numbers 316 and 321. This was attributed to supplier fabrication welding issues that were dispositioned as "Accept-As-Is." The changes were determined to be within the bounds of the approved structural analyses in the Diablo Canyon FSAR.

Safety Evaluation LBIE 2011-003 dated February 16, 2011, documented the placement of six bullet and blast resistant enclosure guard towers around the plant's protected area perimeter to enhance the plant's security system.

## 2.3 Conclusions

All required safety screenings and safety evaluations had been performed in accordance with procedures and 10 CFR 72.48 requirements except for the issue discussed in Section 1.2.g of this report. All other screenings and safety evaluations reviewed were determined to be adequately evaluated.

## 3 **Followup (IP 92701)**

(Closed) Licensee Event Report 47580/PG&E-NRC, loose anchor stud nuts found on casks:

On January 9, 2012, during a walk around on the ISFSI pad, a Diablo Canyon employee noted that a nut on one of the hold down bolts of cask #12 (HI-STORM Serial Number 229-317) was loose. The deficiency was discovered while performing the monthly vent inspection on the upper and lower vents for each HI-STORM. These hold down bolts secure the HI-STORMs to the ISFSI pad to ensure the HI-STORM remains in place if an earthquake were to occur. The operator checked and confirmed the rest of the bolts for cask #12 were tight and initiated condition report SAPN 50451401, dated January 9, 2012.

Per FSAR Section 4.2.1.1.6, each cask is compressed against the embedment plate on top of the ISFSI pad using 16 studs. Each stud is preloaded to approximately 157,000 pounds force (lbf) after a cask is placed on the ISFSI pad. The licensee noted that an analysis was performed previously in Holtec Calculation HI-2012618 Revision 11 (PG&E Calc. 9\*8541, Revision 1) determined that any cask would still maintain stability during a seismic event even if all 16 hold down stud nuts were installed with no pre-load. However, that analysis was not referenced or referred to in the FSAR.

Upon discovery of the loose nut the licensee reviewed its FSAR and Technical Specifications and Diablo Canyon determined that the loose nut did not meet the licensing basis. Therefore, at that time the cask was declared nonfunctional with the safety function of having all studs meeting Section 4.2.1.1.6. of the FSAR. Diablo Canyon initiated Licensee Event Report (LER) Notification 47580, dated January 9, 2012 and reported the situation to the NRC (Adams Accession No. ML12069A015).

On January 10, 2012 the licensee re-tensioned all 16 nuts on cask #12 following the approved tensioning pattern used for placement of a cask on the pad. Based on the discovery of the discrepant nut on cask #12, an extent of condition evaluation was conducted by Diablo Canyon. On January 11, 2012, plant personnel notified Diablo Canyon shift manager that two additional nuts on hold-down studs for two other HI-STORM casks were discovered to be loose. The two additional nuts (one per cask) were discovered when personnel used the full effort of two hands to check all 16 nuts on all 16 cask that were on the ISFSI pad at that time. This issue was updated to the NRC the same day of discovery through an update to the Licensee Event Report Notification 47580. After discovery of the two additional loose nuts, the licensee completed actions to re-tension all nuts on all 16 casks. No additional loose nuts were reported.

The licensee attributed the loose nuts to inadequate cleanliness prior to final tensioning. The licensee SAPN documented that the introduction of a medium grade grain of sand in the bearing area may create a condition that would prevent long term maintenance of

the stud tension forces. The licensee adequately addressed and implemented appropriate corrective actions for the loose anchor stud nuts. To address the issue the licensee implemented the following corrective actions: (1) revised Procedure HPP-1073-400 "Procedure for MPC Transport at Diablo Canyon" to include instructions for cleaning the underside of the HI-STORM and the embedment ring prior to final positioning of the cask; (2) Procedure HPP-1073-400 was changed to direct personnel to re-tension all studs in a second pass after performing the first pass after removing the Vertical Cask Transporter away from the HI-STORM; and (3) Procedure PEP DF-12 "HI-STORM Annual Inspection" was revised to check all anchor stud nuts for looseness on each cask annually.

#### **4 Exit Meeting**

The inspectors reviewed the scope and findings of the inspection during an exit conducted on April 30, 2013.

## SUPPLEMENTAL INSPECTION INFORMATION

### PARTIAL LIST OF PERSONS CONTACTED

#### Licensee Personnel

T. Baldwin, Department Manager, Regulatory Services  
J. Felice, RP Foreman, Radiation Protection Group  
S. Flickinger, Used Fuel Project Manager, Strategic Projects  
R. Hagler, Engineering Supervisor, Strategic Projects  
E. Halpin, Chief Nuclear Officer  
M. McCoy, NRC Interface, Regulatory Services  
L. Million, RP General Foreman, Radiation Protection Group  
L. Pulley, Used Fuel Storage Manager, Strategic Projects  
L. Sewell, Principle Engineer, Radiation Protection

### INSPECTION PROCEDURES USED

IP 60855.1 Operations of an ISFSIs at Operating Plants  
IP 60857 Review of 10 CFR 72.48 Evaluations  
IP 92701 Followup

### LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

#### Opened

72-26/1301-01	NOV	Isolated the canister and placed canister in an unanalyzed condition, violation of 72.48(c)(2)(v), EA-13-090
LER 48965/PG&E-NRC	LER	Licensee Event Report Notification 48965, procedures had placed canisters in an unanalyzed condition.

#### Discussed

None

#### Closed

LER 47580/PG&E-NRC	LER	Licensee Event Report Notification 47580, loose anchor stud nuts found on casks.
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## LIST OF ACRONYMS

ADAMS	Agencywide Documents Access and Management System
ASME	American Society of Mechanical Engineers
BWR	Boiling Water Reactor
CFR	Code of Federal Regulations
CTF	cask transfer facility
DECON	decontamination
DCPP	Diablo Canyon Power Plant
DLR	dose of legal record
DNMS	Division of Nuclear Material Safety
EA	Enforcement Action
FSAR	Final Safety Analysis Report
HIB	Holtec Information Bulletin
IP	inspection procedure
ISFSI	Independent Spent Fuel Storage Installation
ISI	in service inspection
kW	kilo-watt
lbf	pounds force
LBIE	licensing basis impact evaluation
LER	Licensee Event Report
M&M	mechanical and maintenance
mR	milliRoentgen
micro( $\mu$ )R/hr	microRoentgen per hour
micro( $\mu$ )rem/hr	microRoentgen equivalent man per hour
MPC	multipurpose canister
mrem	milliRoentgen equivalent man
MWD/MTU	megawatt days/metric ton uranium
NDE	non-destructive examination
NOV	Notice of Violation
NRC	U.S. Nuclear Regulatory Commission
OPS	operations
PG&E	Pacific Gas and Electric
PM	project management
PWR	pressurized water reactor
QA	quality assurance
REOP	Radiological Environmental Operating Report
RP	radiation protection
RVOA	remote valve operating assembly
SA	Short Anchored
SAPN	system application and process notification
TLD	thermo-luminescent dosimeter
TS	technical specification
WO	work order

**ATTACHMENT 2:**

**LOADED CASKS AT THE DIABLO CANYON POWER PLANT ISFSI**

<b>LOADING ORDER</b>	<b>HI-STORM ID No.</b>	<b>MPC ID No.</b>	<b>Unit</b>	<b>DATE ON PAD</b>	<b>HEAT LOAD (kW)</b>	<b>BURNUP MWd/MTU (max)</b>	<b>MAXIMUM FUEL ENRICHMENT %</b>	<b>PERSON-REM DOSE</b>
1	103	20	1	6/23/09	18.85	44,888	4.61	.370
2	91	12	1	6/30/09	18.92	44,352	4.62	.274
3	80	10	1	7/8/09	20.12	44,967	4.10	.316
4	102	14	1	7/18/09	20.19	44,029	4.10	.245
5	93	17	1	7/26/09	20.21	44,718	4.10	.253
6	95	21	1	8/2/09	20.26	44,999	4.10	.239
7	78	65	1	8/10/09	20.29	44,769	4.10	.196
8	100	8	1	8/17/09	19.07	44,966	4.09	.169
9	322	127	2	5/13/10	19.60	44,864	4.42	.399
10	318	123	2	5/29/10	20.10	44,786	4.41	.319
11	320	126	2	6/6/10	20.16	44,641	4.42	.199
12	317	121	2	6/12/10	20.21	44,922	4.43	.161
13	319	124	2	6/19/10	19.58	44,841	4.12	.139
14	323	120	2	6/26/10	19.63	44,963	4.12	.153

LOADING ORDER	HI-STORM ID No.	MPC ID No.	Unit	DATE ON PAD	HEAT LOAD (kW)	BURNUP MWd/MTU (max)	MAXIMUM FUEL ENRICHMENT %	PERSON-REM DOSE
15	321	125	2	7/3/10	19.65	44,798	4.12	.122
16	316	122	2	7/10/10	19.69	44,710	4.12	.140
17	513	168	1	1/30/12	12.54	47,683	4.10	.167
18	510	167	1	2/12/12	12.71	47,845	4.09	.111
19	506	169	1	2/19/12	13.07	47,398	4.09	.104
20	514	166	2	2/26/12	12.25	46,134	3.73	.075
21	516	170	2	3/5/12	15.38	47,195	4.10	.136
22	507	165	2	3/11/12	16.03	47,018	4.11	.134
23	508	173	2	3/17/12	16.48	46,983	4.11	.129

- NOTES:
- Heat load (kW) is the sum of the heat load values for all spent fuel assemblies in the cask
  - Burn-up is the value for the spent fuel assembly with the highest individual discharge burn-up
  - Fuel enrichment is the spent fuel assembly with the highest average "initial" enrichment percent of U-235

Casks #1 through 8 were loaded to SNM-2511, License Amendment 0, and the Updated Final Safety Analysis Report, Revision 2.  
Casks #9 through 16 were loaded to SNM-2511, License Amendment 1, and the Updated Final Safety Analysis Report, Revision 3.  
Casks #17 through 23 were loaded to SNM-2511, License Amendment 2, and the Updated Final Safety Analysis Report, Revision 3.

All casks are maintained under SNM-2511, License Amendment 2, and the Updated Final Safety Analysis Report, Revision 4.