December 15, 2005

Mr. David H. Oatley
General Manager and Vice President
Acting Chief Nuclear Officer
Pacific Gas and Electric Company
Diablo Canyon Power Plant
P.O. Box 56
Avila Beach, CA 93424

SUBJECT: HUMBOLDT BAY POWER PLANT UNIT 3 - ISSUANCE OF AMENDMENT REGARDING SPENT FUEL CASK HANDLING (TAC NO. L52634)

Dear Mr. Oatley:

The Commission has issued the enclosed Amendment No. 37 to Facility Operating License No. DPR-7 for the Humboldt Bay Power Plant, Unit 3. The amendment consists of changes to the Technical Specifications (TS) in response to your application dated July 9, 2004, as supplemented by letters dated July 9, 2004, August 17, 2004, and June 3, 2005.

The amendment authorizes the use of the Holtec davit crane in the refueling building for cask handling operations.

A copy of our related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

**/RA/**

John B. Hickman, Project Manager
Reactor Decommissioning Section
Decommissioning Directorate
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No. 50-133

Enclosures: 1. Amendment No. 37 to DPR-7
2. Safety Evaluation

cc w/encls: See next page

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| NAME | JHickman | CBurkhalter* | CCraig* | SJones* | KManoly* | STreby (NLO) | DGillen |
| DATE | 11/ /2005 | 10/27/2005 | 11/01/2005 | 10/25/2005 | 12/21/2004 | 12/2/2005 | 12/14/2005 |

OFFICIAL RECORD COPY

Humboldt Bay Power Plant, Unit 3 Service List

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PACIFIC GAS AND ELECTRIC COMPANY

DOCKET NO. 50-133

HUMBOLDT BAY POWER PLANT, UNIT 3

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 37
License No. DPR-7

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Pacific Gas and Electric Company (the licensee), dated July 9, 2004, as supplemented by letters dated July 9, 2004; August 17, 2004; and June 3, 2005, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will be maintained in conformity with the application, as amended, the provisions of the Act, and the applicable rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with applicable portions of the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, by Amendment No. 37, Facility Operating License No. DPR-7 is hearby amended to authorize the licensee to use the Holtec davit crane in the refueling building for cask handling operations, as set forth in the license amendment application dated July 9, 2004, as supplemented by letters dated July 9, 2004; August 17, 2004; and June 3, 2005, and evaluated in the associated safety evaluation by the Commission's Office of Nuclear Material Safety and Safeguards and the Office of Nuclear Reactor Regulation.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 60 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

**/RA/**

Daniel M. Gillen, Deputy Director
Decommissioning Directorate
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Date of Issuance: December 15, 2005

SAFETY EVALUATION BY OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

AND THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 37 TO FACILITY OPERATING LICENSE NO. DPR-7

PACIFIC GAS AND ELECTRIC COMPANY

HUMBOLDT BAY POWER PLANT, UNIT 3

DOCKET NO. 50-133

## 1.0 INTRODUCTION

By letter dated July 9, 2004, as supplemented by letters dated July 9, 2004, August 17, 2004, and June 3, 2005, Pacific Gas and Electric Company (PG&E, the licensee) submitted a request for an amendment to Facility Operating License No. DPR-7 that would authorize the use of the Holtec davit crane in the refueling building for cask handling operations.

The July 9, 2004, August 17, 2004, and June 3, 2005, letters provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original no significant hazards consideration determination published in the *Federal Register* on December 7, 2004 (69 FR 70720).

## 2.0 BACKGROUND

In 1983 PG&E decided to decommission its Humboldt Bay Power Plant (HBPP) Unit 3, which had been in a shutdown mode since 1976 (Chapter 2, ref. 1). A year later the licensee submitted the HBPP Unit 3 SAFSTOR Decommissioning Plan to the U.S. Nuclear Regulatory Commission (NRC). In 1988, the NRC approved the SAFSTOR Decommissioning Plan for Unit 3 and amended the operating license to allow possession but not operation of the facility. The HBPP Unit 3 license expires on November 9, 2015.

The HBPP Unit 3 is permitted to perform decommissioning activities in accordance with 10 CFR 50.82 and consistent with the Post-Shutdown Decommissioning Activities Report that was submitted to the NRC in PG&E Letter HBL-98-002, dated February 27, 1998. However, Section 2.B of the current HBPP Unit 3 License requires HBPP to place and maintain the facility in a SAFSTOR status. In PG&E Letter HBL-04-017, dated June 23, 2004, HBPP submitted License Amendment Request (LAR) 04-03 to modify Section 2.B of the HBPP Unit 3 License to remove the restriction to remain in SAFSTOR and allow the licensee to take actions to decommission and decontaminate the facility. This request was approved by License Amendment No. 35, issued on September 10, 2004, and noticed in the *Federal Register* on September 28, 2004. (69 FR 57998)

The changes proposed by this LAR will allow handling and loading of Holtec International's (Holtec's) multi-purpose canisters and overpack in the HBPP 10 CFR Part 50 facilities. By PG&E Letter HIL-03-001, dated December 15, 2003, PG&E submitted an application to the NRC requesting a site-specific 10 CFR Part 72 license for an Independent Spent Fuel Storage Installation (ISFSI) at HBPP to store the Unit 3 spent nuclear fuel. The project objective is to relocate the fuel assemblies from wet storage in a spent fuel pool (SFP) located in Unit 3, to dry storage containers at an ISFSI.

The ISFSI will use Holtec's 80-ton HI-STAR HB System, consisting of an overpack containing a multi-purpose canister (MPC) for storing spent fuel assemblies and damaged fuel, in the HBPP 10 CFR Part 50 facilities, including the cask pit area in the SFP. As defined in Reference 2 of this SE, an MPC is a sealed spent nuclear fuel container that consists of a honeycombed fuel basket contained in a cylindrical canister shell that is welded to a baseplate, a lid with welded port cover plates, and a closure ring. The MPC provides the confinement boundary for the contained radioactive materials. As defined in Reference 2, overpack is a cask that receives and contains a sealed MPC-HB for transportation to and interim storage in the ISFSI. It provides the helium retention boundary, gamma and neutron shielding, protection against environmental phenomena, and a set of lifting trunnions for handling. The HBPP will use a similar system for storing greater than Class C (GTCC) waste material. The licensee states that all descriptions in this LAR of spent fuel casks also apply to the use of the GTCC cask.

The HBPP has previously made several spent fuel shipments using a NRC approved 60-ton cask. However, the analyses for the use of an 80-ton cask, demonstrating that the associated licensing criteria remain satisfied, have not been approved by the NRC. Also, the Decommissioning Safety Analysis Report (DSAR) currently states that heavy loads will not be allowed over the SFP. In this LAR HBPP submitted the licensing bases for these analyses for NRC review and approval.

As a part of the LAR 04-02, the licensee requested that a proprietary Holtec davit crane be approved by NRC for use to handle and load the HI-STAR HB System. The Holtec davit crane is a 95-ton (190,000 lb) floor-mounted, wall-anchored removable device (chapter 1, ref. 3). It will be installed in the HBPP Unit 3 Refueling Building (RFB) to move the overpack from a rail dolly to the cask loading pit. Major components of the crane include: (1) main beams, (2) U-frame assembly, and (3) the strand jacks (Chapter 4, ref. 4). The two main beams are secured to the spent fuel pool wall via anchors. The U-frame assembly consists of a pair of symmetric pivot booms and a horizontal top connector beam. Hydraulic components (e.g., cylinders, couplings, etc.) and electronic devices monitor the movement of the booms to ensure they operate in unison. The strand jacks mounted on the horizontal connector beam support the lift yoke and raise/lower the HI-STAR HB System.

## 3.0 REGULATORY EVALUATION

General Design Criterion (GDC) 4, “Environmental and Dynamic Effects Design Bases,” of Appendix A to 10 CFR Part 50 specifies, in part, that structures, systems, and components important to safety shall be appropriately protected against dynamic effects, including the effects of missiles, that may result from equipment failures. GDC 2, “Design Bases for Protection Against Natural Phenomena,” specifies, in part, that structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena, such as earthquakes. Section 9.1.5, “Overhead Heavy Load Handling Systems,” of NUREG-0800, “NRC Standard Review Plan,” references the guidelines of NUREG-0612, “Control of Heavy Loads at Nuclear Power Plants,” and NUREG-0554, “Single-Failure-Proof Cranes for Nuclear Power Plants,” for implementation of these criteria in the design of overhead heavy load handling systems.

The basis for the guidelines in NUREG-0612 was to minimize the occurrence of the principal causes of load handling accidents and to provide an adequate level of defense-in-depth for handling of heavy loads near spent fuel and safe shutdown systems. Defense-in-depth is generally defined as a set of successive measures that reduce the probability of accidents and/or the consequences of such accidents. In the area of control of heavy loads, the emphasis is on measures that prevent load drops or other load handling accidents.

In NUREG-0612, the staff provided regulatory guidelines for control of heavy load lifts to assure safe handling of heavy loads in areas where a load drop could impact on stored spent fuel, fuel in the reactor core, or equipment that may be required to achieve safe shutdown or permit continued decay heat removal. In an unnumbered letter dated December 22, 1980, as supplemented by Generic Letter (GL) 81-07, “Control of Heavy Loads,” dated February 3, 1981, the NRC requested that all licensees describe the extent to which the guidelines of NUREG-0612 were satisfied at their facility and what additional modifications would be necessary to fully satisfy the guidelines. This request was divided into two phases (Phase I and Phase II) for implementation by licensees. Phase I guidelines address measures for reducing the likelihood of dropping heavy loads and provide criteria for establishing safe load paths; procedures for load handling operations; training of crane operators; design, testing, inspection, and maintenance of cranes and lifting devices; and analyses of the impact of heavy load drops. Phase II guidelines address alternatives to either further reduce the probability of a load handling accident or mitigate the consequences of heavy load drops. These alternatives include using a single-failure-proof crane for increased handling system reliability, employing electrical interlocks and mechanical stops for restricting crane travel to safe areas, or performing load drops and consequence analyses for assessing the impact of dropped loads on plant safety and operations. Criteria for design of single-failure-proof cranes were included in NUREG-0554.

In GL 85-11, “Completion of Phase II of Control of Heavy Loads at Nuclear Power Plants, NUREG-0612,” dated June 28, 1985, the NRC staff dismissed the need for the NRC to review the Phase II responses received from licensees, based on the improvements observed during review of the Phase I responses. However, GL 85-11 encouraged licensees to implement actions they perceived to be appropriate to provide adequate safety.

In NRC Bulletin 96-02, "Movement of Heavy Loads over Spent Fuel, Over Fuel in the Reactor Core, or Over Safety-Related Equipment," dated April 11, 1996, the staff addressed specific instances of heavy load handling concerns and requested licensees to provide specific information detailing their extent of compliance with the guidelines and their licensing basis.

In a prior safety evaluation (SE), the staff concluded that a cask transfer facility (CTF) had components that were equivalent to that of a bridge girder and that such components should be conservatively designed but need not be considered single failure proof in accordance with NUREG-0554. In the SE on the Dresden CTF, dated June 15, 2001, the staff recognized that the CTF was neither a single-failure-proof crane per NUREG-0554 nor entirely a special lifting device per ANSI N14.6. The staff recognized that the Dresden CTF was a heavy load/jacking system allowed by the flexibility built into Section 3.5, Appendix B to the HI-STORM CoC 72-1014 (ref. 5), and as such, shall be designed and tested in accordance with the intent of NUREG-0612 to achieve improvement in the reliability of handling systems. The staff considered the concept of an inherent safety factor in Subsection NF, Level A stress to be commensurate to those of crane industry standards.

GDC 62, "Prevention of Criticality in Fuel Storage and Handling," states that criticality in the fuel storage and handling systems shall be prevented by physical systems or processes. The staff evaluated the criticality potential of rearranged stored spent fuel in HBPP as stated in Humboldt Bay Power Plant, Unit No. 3 Decommissioning Safety Evaluation Report, dated April 29, 1987.

## 4.0 SYSTEM TECHNICAL EVALUATION

The licensee proposed a specially designed davit crane, which includes strand jacks, that will be qualified in accordance with NUREG-0612 and NUREG-0544 as appropriate, to preclude cask drops, cask tip-over, or other events during transient fuel transfer and transport activities within the 10 CFR Part 50 facilities. The davit crane is a floor-mounted, wall-anchored removable device specifically designed for use at HBPP Unit 3. The davit crane is designed so that its hoisting frame can only travel along one axis of motion. It must swing down from its starting position to lift the overpack from the rail dolly and swing in the opposite direction along the same axis to lower the overpack into the cask loading pit. The davit crane's load path is parallel to, and at no time does it travel directly over, the spent fuel in the SFP storage racks. Therefore, by design the stored spent fuel is not impacted by cask movements. The licensee notes the following major functional design characteristics of the davit crane:

a. The individual component weights are such that the existing overhead crane permits assembly and disassembly.

b. Installation of the crane is essentially a floor-based activity and requires no heavy loads carrying over the SFP with respect to installation.

c. There is no reliance on the strength of the columns and overhead structures in the RFB.

d. The loads from the weight of the cask are reacted by forces that act on the SFP wall and RFB wall.

e. The existing crane is left unaffected in use and maintains all of its current range of motion and capacity.

f. The fuel service platform maintains full operational capability and is unaffected by the presence of the davit crane. No supplemental fuel handling measures are needed.

g. Power is drawn from an electrically-powered hydraulic skid, which can be positioned to best suit the loading operations. The skid can be moved and unplugged so permanent wiring to the crane is not needed.

h. All existing rigging, procedures, personnel qualification, drawings, and systems used with the existing RFB cranes remain unaffected.

In Section 4.2.7 of the application dated, July 9, 2004, the licensee summarized how the objectives and general guidelines in Section 5.1.1 of NUREG-0612 would be satisfied following installation of the davit crane. Section 4.2.7 presented proposed DSAR changes including implementation of the general guidelines with regard to: (1) establishment of safe load paths; (2) development of procedures; (3) training and qualification of crane operators; (4) selection of special lifting devices; (5) selection and use of slings; (6) inspection, testing and maintenance of cranes; and (7) application of standards to crane design. The staff compared these proposed changes with the criteria in Section 5.1.1 of NUREG-0612 and found proposed changes nos. 1 through 6 to be acceptable. The staff determined that the licensee's proposed davit crane meets the intent of proposed change no. 7, application of standards to crane design, as described below.

As stated in Section 4.2.7 of the application dated, July 9, 2004, for the design of the davit crane and strand jack system, the licensee will adopt an approach similar to that of staff-approved Dresden CTF by meeting the applicable criteria of NUREG-0612, NUREG-0554 and ANSI N14.6. Holtec Report HI-2043214 (ref. 3) gives (1) a comparison of the davit crane and strand jack system to the guidance of NUREG-0554 and (2) a failure modes and effects analysis for the davit crane and strand jack system based on these design and operational considerations.

The licensee stated that the proposed davit crane will consist of two strand jacks operating in parallel which combine to raise the total working load to 264 tons and that the strand jack collets automatically adjust for slack in any individual strand so that the strands would be evenly loaded (ref. 3). The staff requested additional information from the licensee in a letter dated December 9, 2004, (ML043440350) related to (1) how the two strand jacks automatically operate in unison to lift the load evenly, (2) means to correct uneven lifting if discovered, and (3) the effect of uneven loading on the ability of the crane to stop and hold the load and to what extent stresses in load bearing members were evaluated for uneven loading conditions. In response to the staff's request, the licensee stated in a letter, dated June 3, 2005, that the jacks are precision-machined devices, which are factory and field tested to ensure uniform movement through the entire range of the lift. During each lifting cycle, all jacks are cycled in unison through their full range. The cycle is not complete until all jacks have reached their full extension. If a jack were to attempt to lag behind the other jacks, fluid, following the path of least resistance, would instantaneously flow to the lagging jack until the jack pressure matched the remaining jacks, thus bringing all jacks back into equilibrium. At the top of the stroke, all three jacks would automatically top-out bringing all six jacks back into phase. The licensee will test the jacks lifting in unison as part of the start-up test program. The davit crane's design with capability to automatically operate the two strand jacks in unison to lift the load evenly is acceptable to the staff.

The licensee stated that uneven lifting of the load is not possible with the davit crane. The connection between the strand anchor block and the lift yoke is via a single, centrally located pinned connection, which allows the lift yoke to pivot. The pivoting ability of the strand anchor block maintains the same load on each strand jack. If one strand jack were discovered to be significantly lagging, the "slack side" can be individually advanced to bring the system back into full balance by using the locked-out bypass mode of the strand jack drive system. This bypass capability is necessary to balance the system during the initial setup of the davit crane. Prior to each lift, the system is visually examined and tested to verify that the jacks are operating in unison and the load is evenly balanced. This response shows that the davit crane's design provides means to correct uneven lifting if discovered, and therefore, is acceptable to the staff.

The licensee stated that the design analysis did not include uneven loading because it is a non-credible event for the davit crane and that the individual parts of the crane were designed with a significant safety factor so that they would not overstress even if some uneven loading occurs. Because the licensee has shown that the davit crane's design prohibits uneven loading and provides means to correct it if that occurs, this response is acceptable to the staff.

In the December 9, 2004, request for additional information (RAI), the staff requested that the licensee describe how the hydraulic pressure in the strand jacks is regulated/relieved to prevent a two-block event or a load hang-up event, the effect of a possible failure the pressure regulation/relief, and if this involves manual actions, their complexity. In response to the staff's RAI, the licensee stated in a letter, dated June 3, 2005, that the hydraulic system used to control the strand jacks uses counterbalance valves to regulate and relieve hydraulic pressure. The regulator relief setting of the counterbalance valve corresponds to an available lift force in the jacks. Pressure is regulated such that the limiting lift force in the jacks equals the load, plus some small amount of the lifting force (e.g., 10 percent to 20 percent). The pressure relief exhaust directs hydraulic pressure back to the reservoir. The pressure relief settings of the counterbalance valves will enable the system to detect a two-block event or a load hang-up event. This detection will prevent the jacks from exerting a force sufficient to damage themselves, the cask, or any of the load handling components. Redundant pressure relief valves will ensure complete protection of the system. The pressure relief valves provide a third and fourth level of defense, following the upper and lower limit switches, and do not require any manual actions to operate. This response shows that the davit crane provides adequate protection against a two-block event or a load hang-up event, and therefore, is acceptable to the staff.

The submittal, dated July 9, 2004, stated that the davit crane does not employ holding brakes and that stopping and holding are passive safety features of hydraulics. In the December 9, 2004, RAI, the staff requested that the licensee describe: (1) the passive safety features of the hydraulics; (2) the dynamic effects on the system from sudden movement, e.g., loss of hydraulic power by a rupture of a hydraulic line; and, (3) how the licensee would monitor and control the effect of wear and the resulting drop in frictional load holding capacity during the life of the crane. In response, the licensee stated in a letter, dated June 3, 2005, that both positioning cylinders are equipped with counterbalance valves, which passively protect the hydraulic systems by requiring hydraulic pressure in the line to extend or retract the cylinders. Figure 1 shows a schematic of a typical counterbalance valves with three ports to control the fluid flow to the cylinder. Hydraulic fluid is free to flow from Port 2 to Port 1 of the counterbalance valve. The check valve prevents the reverse flow from Port 1 to Port 2 unless (1) Port 3 is pressurized or (2) pressure at Port 1 exceeds the relief valve setting. Fluid flowing from the pump to the extend side of the double-acting hydraulic cylinders, as shown in Figure 2, causes the cylinders to extend and lift the load. During lifting, the check valve of the counterbalance valve prevents fluid flow out of the extend side. To lower the load the cylinders are retracted by applying pressure to the retract side of the cylinder. The same pressure is applied at Port 3 of the extend side counterbalance valve, which opens the pilot operated relief valve, allowing fluid to flow from the extend side of the cylinder to the reservoir, and thus, allowing the cylinder to retract. The speed of travel of both the strand jack motion and the davit positioning cylinders is limited to 12 inches per minute by equipment sizing and is not adjustable by the equipment operator.

Describing the dynamic effects on the system from sudden movement, the licensee stated, in its response, dated June 3, 2005, that the counterbalance valves protect the davit crane against additional loads imparted by any hydraulic line failure of loss of hydraulic pressure. Figure 2 shows the counterbalance valves and identifies extend and retract hydraulic lines as Lines B and A. If Line B fails catastrophically during a load lift, the check valve in the extend-side counterbalance valve prevents the reverse flow from the extend side of the cylinder, thus locking the cylinder in place. If Line A fails during load lowering, the loss of pressure at Port 3 causes the extend-side counterbalance valve to close preventing the venting of hydraulic fluid from extend side of the cylinder, thus locking the cylinder in position. A lock-up of the cylinders causes the crane to make a normal stop and remain in safe condition without requiring any manual actions. All active lifting components are accessible and can be repaired or replaced with a load on the crane without risk of a load drop.

The failure of the return line, as shown in Figure 2, in any of the four cases does not result in any loss of control of the load, as the counterbalance valves will continue to control the travel at the designated speed by the orifice size in the counterbalance valves. Directly mounting the counterbalance valves to the cylinder eliminates the potential for a line failure at the cylinder hydraulic connection.

In all cases, the cylinder is protected against a catastrophic line failure. The three-way valve shown in Figure 2 prevents pump pressure from reaching the retract side and extend side simultaneously.

Describing how it would monitor and control the effect of wear and the resulting drop in frictional load holding capacity during the life of the crane, the licensee stated, in its response, dated

June 3, 2005, that the strands are rated for loads significantly larger than design davit crane load (264 ton versus 95 ton). The strand service life is also rated well beyond that expected by the davit crane. While the manufacture's recommended life is several hundred lifts the required lifting is six casks. Even with several test loads, the number of lifts is a small fraction of the expected life. The licensee will inspect the strands before each lift for wear and replace them, if required, per manufacture's recommendations. Per the strand jack manufacture, the collet chucks last for the life of the unit. Most users are heavy equipment installation specialists, who have had collet chucks in service for over 15 years.

The staff accepts the licensee's response which shows that although the davit crane does not employ holding brakes (1) it has passive safety features of hydraulics to stop and hold the load; and (2) it is equipped with the counterbalance valves protecting it against additional loads imparted by any hydraulic line failure of loss of hydraulic pressure. In addition, wear of strands is not an issue, because they are used below the design capacity, the crane has a limited use, and the licensee will inspect the strands before each lift and replace them, if needed.

Therefore, the staff determined that the licensee's proposed davit crane meets the intent of measure no. 7, application of standards to crane design, of objectives and general guidelines in Section 5.1.1 of NUREG-0612.

Phase II guidelines in GL 81-07 address alternatives to either further reduce the probability of a load handling accident or to mitigate the consequences of heavy load drops. These alternatives include using a single-failure-proof crane for increased handling system reliability, employing electrical interlocks and mechanical stops for restricting crane travel to safe areas, or performing load drops and consequence analyses for assessing the impact of dropped loads on plant safety and operations.

The davit crane design cannot be fully qualified as a single-failure-proof crane as defined in NUREG-0554. Therefore, the staff evaluated the HBPP davit crane using the criteria outlined in Section 5.1 of NUREG-0612. These criteria include the following:

- Releases of radioactive material that may result from damage to spent fuel based on calculations involving accidental dropping of a postulated heavy load produce doses that are well within 10 CFR Part 100 limits of 300 rem thyroid, 25 rem whole body (analyses should show that doses are equal to or less than 1/4 of Part 100 limits);

- Damage to fuel and fuel storage racks based on calculations involving accidental dropping of a postulated heavy load does not result in a configuration of the fuel such that $k_{eff}$ is larger than 0.95; and

- Damage to the spent fuel pool based on calculations of damage following accidental dropping of a postulated heavy load is limited so as not to result in water leakage that could uncover the fuel (makeup water provided to overcome leakage should be from a borated source of adequate concentration if the water being lost is borated).

In its SE on Humboldt Bay Power Plant Unit No. 3 Decommissioning, dated April 29, 1987, the staff stated that it determined the (0-to-2-hour) offsite radiological consequences of non-mechanistic heavy load drop in the spent fuel. Assuming damage to all of the pins in each of the 390 spent fuel assemblies and a minimum of 8-year cooldown time (although actual cooldown then was over 10 years), the staff calculated consequences of 20-mrem whole body dose and negligible thyroid dose (less than 0.1 mrem). These consequences were well within the guidelines of 10 CFR Part 100.

In the above dose estimates, the staff assumed that the release took place through the 50-ft stack. The licensee reevaluated dose consequences by assuming; (1) failure of refueling building ventilation system release thus conservatively releasing radionuclides at ground level, and (2) damage to all of the pins in each of the 390 spent fuel assemblies and a minimum of 23-year cooldown. The licensee calculated consequences of 72.3-mrem whole body dose and negligible thyroid dose. Although, the licensee calculated whole body dose was higher than that calculated by the staff, it is well within the guidelines of 10 CFR Part 100.

The staff evaluated the criticality potential of rearranged stored spent fuel in HBPP as stated in Humboldt Bay Power Plant, Unit No. 3 DSAR, dated April 29, 1987. In its SE the staff noted that to preclude criticality in the spent fuel storage pool following an event which results in movement or damage to the fuel assembly storage racks, the licensee enclosed each fuel assembly in a can fabricated from a neutron absorbing material. The can contained an areal density (0.005 gm/cm$^2$) of boron B-10 to maintain $k_{eff}$ less than 0.95. As stated in Section 10.3 of the SE, the staff concluded that there was a negligibly small likelihood that there was any credible means of producing criticality in the stored spent fuel array. The staff clarified in the SE that negligibly small meant in that context that the probability of occurrence was so small that the consequences of such an event did not need to be evaluated. The licensee stated that no changes proposed in the present LAR would adversely affect the criticality analysis of spent fuel stored in the spent fuel racks or being handle within the SFP. The staff also found no such changes proposed by the licensee, and thus, agrees with the licensee.

In its Humboldt Bay Power Plant, Unit No. 3 DSAR, dated April 29, 1987, the staff noted that after a loss of SFP water resulting from an accidental rupture of SFP there would be no release of radioactivity due to heatup of fuel since the decay heat generation rate was less than 100 W per fuel assembly, which would allow the fuel to cool in air by convection currents. After continued decay of radioisotopes since then to the present, the decay heat generation rate is significantly less than 100 W per fuel assembly, further assuring that spent fuel can be cooled in air by convection currents without a need to rely on water in the SFP for cooling the spent fuel. Therefore, uncovering fuel resulting from a heavy load drop at HBPP SFP would not be a concern.

The staff determined that the davit crane meets GDC 4 because the licensee follows the staff's regulatory guidelines for control of heavy load lifts provided in NUREG-0612: (1) Phase I guidelines to address measures for reducing the likelihood of dropping heavy loads that could impact on stored spent fuel, and (2) Phase II guidelines to mitigate the consequences of heavy load drops.

GDC 2, “Design Bases for Protection Against Natural Phenomena,” specifies, in part, that structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena, such as earthquakes. The licensee notes that “In developing its design approach for the seismic aspects in the RFB, PG&E decided to qualify all new equipment to be installed in the RFB to 0.5g since the structural integrity of the building had not been analyzed for accelerations exceeding these levels.” (Section 4.2.8, ref. 1)

Design guidance in Section 2.5 of NUREG-0554 states that “The cranes should be designed to retain control of and hold the load, and the bride and trolley should be designed to remain in place on their respective runways with their wheels prevented from leaving the tracks during a seismic event.” The licensee stated that “The davit crane has no moving bridge or trolley. The top beam can retain control of the load during the safe shutdown earthquake evaluation of RFB event.” (Page 5, ref. 3) Design guidance in Section 2.5 of NUREG-0554 states that “If a seismic event comparable to a safe shutdown earthquake occurs, the bridge should remain on the runway with brakes applied, and the trolley should remain on the crane girders with brakes applied.” The licensee stated that this guidance does not apply to the davit crane because it has no moving bridge or trolley.

The staff determined that the davit crane meets GDC 2, because its structural integrity is maintained during a during a design basis earthquake, as discussed in section 5.0 of this SE, and because it meets applicable guidance provided in NUREG-0554.

GDC 62, “Prevention of Criticality in Fuel Storage and Handling,” states that criticality in the fuel storage and handling systems shall be prevented by physical systems or processes. As stated before (1) the staff concluded previously that there was a negligibly small likelihood that there was any credible means of producing criticality in the stored spent fuel array and (2) the staff did not find any proposed changes by the licensee that would affect that conclusion. Therefore, the staff determined that HBPP meets GDC 62.

The licensee stated in its original submittal, dated July 9, 2004, that it performed a probabilistic evaluation to determine that the probability of a cask drop causing a radiological release exceeding the guidelines of 10 CFR Part 100 or a criticality event was less than 1x10-7 and therefore was not credible." Because it was not clear form the submittal, dated July 9, 2004, the staff requested that the licensee describe the sequence of events that led to the cask dropping and how the cask dropping probability was determined.

In response, the licensee stated in a letter, dated June 3, 2005, that the cask dropping probability was determined by performing a probabilistic risk analysis (PRA) using NUREG-0612 Appendix B probabilistic techniques and associated human actions and hardware failures, and supplemented with updated cask drop reliability information in NUREG-1774. The PRA is consistent with the risk evaluation in NUREG-1738. The PRA used the Humboldt Bay ISFSI specific number of cask handling activities (16 lifts) and assumed a non-mechanistic drop. The resultant release probability is 8.96 E-9, which is well under the 7.0 E-7 threshold.

The licensee provided its PRA analysis in Enclosure 2 to its response dated June 3, 2005. In reviewing this PRA analysis the staff found that the licensee used operating event data reported in NUREG-1774 which are not applicable to the current LAR because davit cranes are not generally used in nuclear power plants. Therefore, the staff did not use the licensee's PRA results for this LAR.

## 5.0 STRUCTURAL TECHNICAL EVALUATION

### A. Construction of the Davit Crane

The davit crane is a floor-mounted, removable device specifically designed for use at Humboldt Bay Power Plant (HBPP) Unit 3. The davit crane consists of a pair of main steel beams, a pivoting U-frame assembly, strand jacks and control systems. The main steel beams bridge between the top of the spent fuel pool (SFP) wall and the adjacent RFB wall. At the SFP wall end, the main beams are secured to the top of the SFP wall by anchors. Steel plates are mounted on the top of the SFP wall to distribute the concentrated loads from the steel main beams. The opposite ends of the main beams are anchored to the RFB wall by through bolts. The main beams provide the mounting location for a U-frame assembly. The U-frame assembly consists of a pair of symmetric pivot booms and a horizontal top connector beam. The booms are structural steel beams that have large pinhole locations on each end. The top pin location accepts the pins from the end of the top horizontal beam. The lower pinholes accepts the pins located in the pivot mounts. A pinned connection at the SPF end provides the pivot location for the boom of the U-frame assembly. The U-frame assembly pivots about its pivot pins to position the top beam over the SFP or over the truck bay.

The physical movement is controlled by a pair of 100 ton hydraulic cylinders. Cylinder lug mounts are located on the booms for mounting the hydraulic cylinders. The hydraulics are equipped with several redundant features to prevent uncontrolled movement of the load. Both cylinders are equipped with controlled fluid metering to ensure that both cylinders operate in unison. Each cylinder is also equipped with electronic position controls to monitor and adjust the cylinder travel as necessary. Each cylinder is equipped with counter balance valves that "lock up" the cylinder in the event of a hydraulic failure or pump malfunction. The davit crane is designed so that its hoisting frame can only travel, along one axis of motion. The davit crane is designed to swing from its starting position to lift the empty cask from the spent fuel pool rail dolly and swing in the opposite direction along the same axis to lower the cask into the cask loading pit. The top beam supports a pair of symmetrically-positioned, hydraulically operated strand jacks that raise and lower the lift yoke. The top beam is equipped with holes that allow for the passage of individual high strength strands and provide bolting locations for the mounting of the strand jacks.

The strand jacks are equipped with multiple safety features including redundant load paths, excess load carrying capacity, and hydraulic pressure relief settings. The strand jacks are equipped with redundant limit switches that limit upward movement. Each strand jack contains a cluster of 12 strands and each strand is constructed from seven high strength steel wires with a minimum breaking strength of 58,600 pounds each. The strands are commercial materials and have been used widely in prestressed concrete structures. The 12 strands in a single cluster provides a working load of 132 tons (a total working load of 264 tons for two strand jacks.) The strand jacks can withstand a failure of up to six strands and still maintain a safety factor of 5.

B. Analysis of the Davit Crane

A finite element analysis was performed using the QA validated ANSYS 5.7 code for the davit crane. Loading combination used in the analysis included the dead load, normal operation load, and a Safe Shutdown Earthquake event. Nodal forces obtained from the finite element analysis were used to calculate stresses in the bolts and bending moments for welded connections. Stress limits of ASME Subsection NF were used as acceptance criteria.
The analysis results indicate that the SFP wall, over which the davit crane is mounted, will withstand the combined loads induced by the weight of the davit crane, the lifted load, the weight of the SFP wall and the hydrodynamic loads under normal and earthquake loads. A minimum safety factor for the SFP wall is 1.41. The analysis results also indicated that the RFB wall, on which the beams were anchored, can adequately resist the reaction loads and remain within the allowable stresses. A minimum safety factor for the RFB wall is 14.73.

The calculated stress, allowable stress, and safety factor for the davit crane and its anchors, the SFP wall, and the RFB wall were tabulated in Table 1 of the July 9, 2004 submittal. The calculated stresses are less than their respective allowable stresses. The safety factors are greater than one.

Dynamic simulations were performed, using VisualNastran computer code, to predict whether the cask on the rail dolly would remain stable during a Safe Shutdown Earthquake event. The analysis results confirmed that the cask would not overturn during a Safe Shutdown Earthquake event.

C. Load Testing of the Davit Crane

The davit crane structure, strand jacks, and the strands will be tested prior to the delivery to the HBPP site. A pre-operation functional test of the entire crane including the strand jack lift system will be performed prior to cask loading activities.

D. Evaluation of the Davit Crane

Steel frames, 7-wire strands for lifting loads, hydraulic cylinders with control systems for jacking purposes have been commonly used to apply loads on structures in laboratories. The staff has evaluated the construction of the davit crane, as described, and agrees with the licensee that it will result in satisfactory usages for the cask handling operation.

The staff finds that the licensee has used proper methods, loads, and loading combinations to analyze the davit crane including its anchorages, and the SPF and RFB walls. The analysis results, as shown in Table 1 of the July 9, 2004 submittal, demonstrate that (1) the structural components of the davit crane are within allowable stress limits under all applicable loading combinations, (2) the anchorages at the RFB wall and at the top of the SFP wall are secure and satisfy the allowable stress limits during the operation of the davit crane, and (3) both the SPF and RFB walls are capable of sustaining the combined effect of the lifted load and earthquake events.

The staff finds the load test of the davit crane components prior to the delivery to the HBPP site and a pre-operation functional test of the entire crane at the site to be prudent.

## 6.0 SUMMARY

The changes proposed by this LAR will allow the licensee to use a proprietary Holtec davit crane to handle and load the HI-STAR HB System. On the basis of its review, the NRC staff concluded that the licensee's request for the use of the davit crane in its RFB is acceptable because the proposed davit crane meets the guidance in 10 CFR Part 50, Appendix A, GDC 2, 4, and 62. During its review the staff used previous staff determinations and regulatory guidance provided in NUREG-0612 to minimize the occurrence of the principal causes of load handling accidents in nuclear power plants and to provide an adequate level of defense-in-depth for handling of heavy loads near spent fuel pools.

Based on its review of the construction and analysis of the davit crane in support of the Technical Specification Amendment to license DPR-7 for the Humboldt Bay Nuclear Plant Unit 3, the staff agrees with the licensee's determination regarding the structural adequacy of the davit crane and supporting components for the cask handling operation.

The staff, therefore, concludes that the LAR is acceptable.

## 7.0 STATE CONSULTATION

In accordance with the Commission's regulations, the California State official was notified of the proposed issuance of the amendment. The State official had no comments.

## 8.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (69 FR 70720). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

## 9.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of the amendment will not be inimical to the common defense and security nor to the health and safety of the public.

## 10.0 REFERENCES

1. "Humboldt Bay Power Plant, Unit 3 Defueled Safety Analysis Report," Revision 4, submitted to NRC as Enclosure B of Pacific Gas and Electric Letter HBL-02-016, August 31, 2002, ADAMS Accession # ML022480144 (Non-publicly available).

2. 10 CFR 72 Humboldt Bay ISFSI License Application, Attachment C, Pacific Gas and Electric Letter HBL-03-001, December 15, 2003, ADAMS Accession # ML033640451 (Non-publicly available).

3. "Humboldt Bay Davit Crane Specification," Holtect Report No: HI-2043214, Rev. 2, Holtec International, submitted to NRC as Enclosure 1 of Pacific Gas and Electric PG&E Letter HBL-04-022, August 17, 2004, ADAMS Accession # ML042430476 (Non-publicly available).

4. Pacific Gas and Electric PG&E Letter HBL-04-016, Enclosure, July 9, 2004, ADAMS Accession # ML042020451 (Non-publicly available).

5. 10 CFR 72 Certificate of Compliance for HI-STORM 100 System Dry Cask Storage System, 72-1014, Holtec International, Rev. 0, May 2000.

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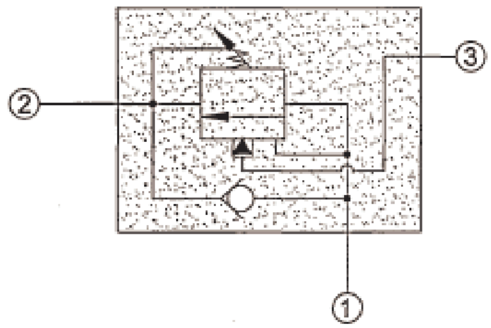


Figure 1.  Counterbalance valve schematic

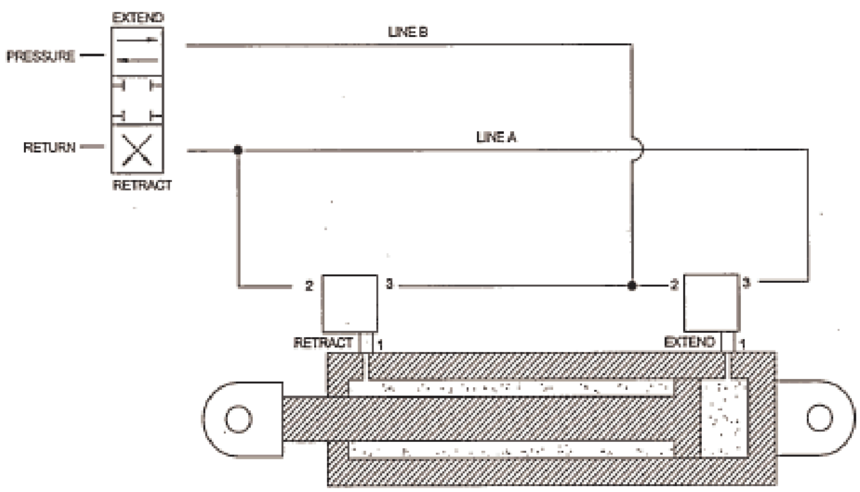


Figure 2.  Double-acting counterbalance valve system for the davit crane