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October 4, 2012

PG&E Letter HIL-12-003

ATTN: Document Control Desk
Director, Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

10 CFR 72.56

Docket No. 72-27, Materials License No. SNM-2514
Humboldt Bay Independent Spent Fuel Storage Installation
<u>License Amendment Request 10-01, Revision 1</u>
<u>Revision to License Condition 7.B</u>

Dear Commissioners and Staff:

On September 8, 2010, Pacific Gas and Electric Company (PG&E) submitted License Amendment Request (LAR) 10-01 in PG&E letter HIL-10-005, "License Amendment Request 10-01, Revision to License Condition 7.B," as an application for amendment to Materials License No. SNM-2514, Docket No. 72-27, for the Humboldt Bay (HB) Independent Spent Fuel Storage Installation (ISFSI). PG&E proposed to change License Condition 7.B by adding process wastes to the Chemical and/or Physical Form description of Greater Than Class C (GTCC) Waste, authorized to be received, possessed, transferred, and stored at the HB ISFSI.

Following NRC review of LAR 10-01, the NRC issued Requests for Supplemental Information (RSIs) on November 9, 2010, and issued a Request for Additional Information (RAI) on June 10, 2011. PG&E responded to the RSIs on January 28, 2011, in PG&E Letter HIL-11-002, "Supplemental Information for License Amendment Request 10-01, Revision to License Condition 7.B," and responded to the RAI on September 9, 2011, in PG&E Letter HIL-11-006, "Response to NRC Request for Additional Information for License Amendment Request 10-01, Revision to License Condition 7.B."

As a result of continuing NRC review of LAR 10-01, PG&E is submitting Revision 1 to LAR 10-01 that contains information provided in the three previous submittals (HIL-10-005, HIL-11-002 and HIL-11-006). This revision is necessary because PG&E has modified the design and approach to processing the GTCC Waste Container (GWC). LAR 10-01, Revision 1, includes a description of the revised design and processing plan and supersedes in entirety the original LAR 10-01 plus the responses to the RSIs and the RAI.

The enclosed revised application for amendment to Materials License No. SNM-2514, Docket No. 72-27, for the HB ISFSI is being provided in accordance with 10 CFR 72.56. LAR 10-01, Revision 1, proposes to change Materials License No. SNM-2514, Condition 7.B, regarding the Chemical and/or Physical Form definition of GTCC Waste.

PG&E's proposed GTCC waste definition is consistent with the definition provided in NRC Spent Fuel Project Office Interim Staff Guidance (ISG) – 17, "Interim Storage of Greater Than Class C Waste." Currently License Condition 7.B defines GTCC waste as being activated metals. The Technical Review Guidance section of ISG-17 defines two categories of reactor-related GTCC wastes: (1) activated metals, and (2) process wastes generated from the operations and decommissioning of reactors. The GTCC waste definition of activated metals and process wastes is repeated in the attachment to ISG-17, which recommends changes to Section 4.5.1.3, "Reactor-Related GTCC Waste," in NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities." LAR 10-01, Revision 1, proposes to add process wastes to License Condition 7.B, consistent with ISG-17.

There are GTCC wastes that consist of activated metals and process wastes currently onsite at Humboldt Bay Power Plant (HBPP) Unit 3. PG&E has planned to store both forms of GTCC waste in the sixth cask at the HB ISFSI. The sixth cask is designed for GTCC waste storage of the types of material described in ISG-17.

Enclosure 1 to this letter includes a description of the proposed change to License Condition 7.B, and the supporting technical analysis. Enclosure 2 provides a markup of License Condition 7.B showing the proposed change for NRC approval. Enclosure 3 provides a retyped (clean) version of License Condition 7.B incorporating the proposed change for NRC approval.

PG&E has determined that this LAR revision is consistent with the environmental considerations that govern the issuance of the initial ISFSI SNM License in accordance with 10 CFR 72.58. Pursuant to 10 CFR 51, PG&E has performed an environmental assessment that is included in Enclosure 4.

Enclosure 5 includes technical information previously sent to the NRC in response to the RSIs and RAI, as revised to reflect the new GWC design.

Enclosure 6 includes a markup of proposed HB ISFSI Final Safety Analysis Report (FSAR) changes that reflect the addition of process waste in the definition of GTCC waste, provides drawings of the Process Waste Container (PWC) and the GWC, and also describes the loading and sealing operations for the GTCC Cask. In addition, the PWC, GWC and GTCC Overpack were added to the HB ISFSI FSAR Important To Safety classification table.

Enclosure 7 includes a retyped (clean) version of the proposed HB ISFSI FSAR changes.

PG&E requests the NRC to process this LAR revision as soon as possible to support loading of GTCC wastes into the sixth ISFSI cask. PG&E requests revised License Condition 7.B be made effective upon NRC issuance, and to be implemented within 30 days of issuance.

If you have any questions or require additional information, please contact Mr. David Sokolsky at (415) 973-5024.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on October 4, 2012.

Sincerely,

Edward D. Halpin
Senior Vice President and Chief Nuclear Officer

Enclosures

cc: William C. Allen, NRC Project Manager
Elmo E. Collins, Regional Administrator, NRC Region IV
John B. Hickman, NRC Project Manager
Gonzalo L. Perez, California Department of Public Health
Humboldt Distribution

EVALUATION

1.0 DESCRIPTION

This License Amendment Request (LAR) proposes to amend Materials License No. SNM-2514 (Reference 6.1) for the Humboldt Bay (HB) Independent Spent Fuel Storage Installation (ISFSI). The proposed change would revise License Condition 7.B.

The LAR proposes to modify License Condition 7.B to have the Greater Than Class C (GTCC) waste definition be consistent with the definition provided in NRC Spent Fuel Project Office Interim Staff Guidance (ISG) – 17, "Interim Storage of Greater Than Class C Waste" (Reference 6.2). Currently License Condition 7.B defines GTCC waste as being activated metals. The Technical Review Guidance section of ISG-17 defines two categories of reactor-related GTCC wastes: (1) activated metals, and (2) process wastes generated from the operations and decommissioning of reactors. The GTCC waste definition of activated metals and process wastes is repeated in the attachment to ISG-17, which recommends changes to Section 4.5.1.3, "Reactor-Related GTCC Waste," in NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities."

There are GTCC wastes that consist of activated metals and process wastes currently onsite at Humboldt Bay Power Plant (HBPP) Unit 3. Pacific Gas and Electric Company (PG&E) has planned to store both forms of GTCC waste in the sixth cask at the HB ISFSI. The sixth cask is designed for GTCC waste storage of the types of material described in ISG-17.

2.0 PROPOSED CHANGE

Currently, License Condition 7.B describes the Chemical and/or Physical Form of GTCC Waste to be stored in the sixth cask as being activated metals comprised of miscellaneous solid waste resulting from reactor operation and decommissioning. PG&E proposes to add process wastes comprised of miscellaneous solid waste resulting from reactor operation and decommissioning to the Chemical and/or Physical Form of GTCC Waste.

The current License Condition 7.B wording is not consistent with ISG-17. By adding "and process wastes" to the sentence, License Condition 7.B becomes technically accurate, as well as consistent with ISG-17.

The proposed wording change to License Condition 7.B is contained in Enclosures 2 and 3 of this letter. Enclosure 2 contains the mark-up of License Condition 7.B, and Enclosure 3 contains the clean, re-typed version of License Condition 7.B.

3.0 BACKGROUND

On December 15, 2003, PG&E applied for a license to store spent fuel and GTCC waste at the HB ISFSI (Reference 6.3). The application letter proposed that the license "...include the capability to store GTCC waste in accordance with...the guidance of Interim Staff Guidance ISG-17." When the NRC issued HB ISFSI License SNM-2514 on November 17, 2005, the Chemical and/or Physical Form of GTCC Waste was described as being from activated metals, and did not include process wastes as being GTCC waste. This description is not consistent with ISG-17 which describes GTCC waste as being from activated metals as well as process wastes. The NRC Safety Evaluation Report (SER) (Reference 6.4) associated with the issuance of the license indicates that a GTCC cask is allowed. Section 4.1 of the SER states that the contents of the cask were defined in Section 3.1 of the HB ISFSI Safety Analysis Report (SAR), and that the cask dose was bounded by the design basis spent fuel cask.

Section 3.1.1.4 of the SAR states that SAR Table 3.1-3 identifies a list of activated components and material that may be stored in the ISFSI as GTCC waste. Section 3.1.1.4 also states that an accurate classification of the waste material will be performed prior to loading the GTCC cask.

At the time the SAR was written and the initial license application was issued, PG&E personnel considered that GTCC wastes to be stored in the ISFSI would consist of activated metals. As decommissioning activities commenced, it became apparent that process waste was also generated and would require storage. However, PG&E personnel did not recognize that the wording in License Condition 7.B could be interpreted as being more restrictive than ISG-17(i.e. GTCC wastes to include only activated metals, and not process waste).

Subsequent discussions with NRC personnel involved with the original license issuance revealed that either the NRC was not aware that process wastes would be included in the sixth ISFSI cask, or that not including process wastes in License Condition 7.B was an oversight. It appears to PG&E that the NRC did not intend to exclude process wastes from being loaded in the sixth ISFSI cask.

PG&E personnel have characterized wastes in preparation for loading GTCC wastes in the HB ISFSI. As part of this process, PG&E has reviewed licensing basis requirements. As a result of this review, PG&E realized that process wastes will be a source of GTCC wastes at HBPP Unit 3, and, therefore, License Condition 7.B needs to be revised to be consistent with ISG-17.

The original LAR 10-01, submitted in PG&E letter HIL-10-005, dated September 8, 2010, was based on a GTCC Waste Container (GWC) design and processing plans that included grout. Subsequently, PG&E realized that a GTCC cask containing grout may generate a flammable hydrogen gas mixture that will preclude shipping offsite, and therefore would not facilitate decommissioning the ISFSI in accordance with 10 CFR 72.130. As a result, PG&E modified the design of the GWC to be virtually identical to the Multi-Purpose Canisters (MPCs) used in the spent fuel casks stored at the HB ISFSI. The new GWC design and processing plans include vacuum drying and helium backfill to prevent the possibility of creating a flammable mixture of hydrogen producing materials. This is a similar approach used in the industry at other decommissioned nuclear power reactors in which the GTCC waste has been stored at an ISFSI.

The elimination of grout from the design also eliminated a measure of stability provided for the activated metal pieces that will be loaded in the GWC. However, the activated metal pieces will be loaded using a loading plan that strategically places the pieces in a configuration that minimizes movement and potential secondary impacts. The activated metal pieces will be loaded into the GWC vertically, and the GWC will remain in the vertical position within the HI-STAR HB GTCC Overpack during transfer from the refueling building to the ISFSI and during storage in the ISFSI.

PG&E changed the design of the Process Waste Container (PWC) that will store the GTCC process waste since the original LAR 10-01 submittal. The PWC design has been modified to replace the welded lid with a mechanically sealed lid. This design change was needed because welding the lid was difficult due to the high dose environment.

The GTCC process waste contained in the PWC is thermally processed offsite at a vendor's facility. A dry heating process known as dry-ashing is used to remove organics and other hydrogen-bearing components from the process waste to produce a dry concentrated residue. The residue will have sufficiently low hydrogen content to mitigate the formation of hydrogen gas from radiolytic decomposition in long term storage casks. This is needed to maintain hydrogen at less than 5 percent by volume of the PWC void space in accordance with USNRC Information Notice 84-72, "Clarification of Conditions for Waste Shipments Subject to Hydrogen Gas Generation," dated September 10, 1984 (Reference 6.5). After the dry-ashing process is complete, the vendor vacuum dries the PWC, installs a mechanical seal, backfills the PWC with helium and conducts a leak test in accordance with ANSI N14.5, "Radioactive Material-Leakage Tests On Packages For Shipment" (Reference 6.6). The PWC will be returned to HBPP and stored in the spent fuel pool (SFP), a wet environment; however, the process waste contained in the PWC will remain dry. The overpack containing the GWC will be placed in the SFP. The PWC will be loaded into the GWC in the SFP. The PWC will be placed within the outer container, which is a section of pipe welded to the bottom of the GWC. The outer container is designed to provide stabilization for the PWC. The outer container has drains at the bottom to facilitate vacuum drying of the annulus between the PWC and the outer container. A lid will be placed on the Outer Container to serve as a barrier to prevent co-mingling with the activated metal components.

The activated metals will be loaded into the GWC after the PWC has been loaded into the GWC. The activated metals will be placed outside the outer container and on the outer container lid. The GWC will be moved out of the SFP, drained, vacuum dried, backfilled with helium and leak tested.

Additional technical information previously sent to the NRC in response to the Requests for Supplemental Information and Requests for Additional Information, is included in Enclosure 5 as revised to reflect the new GWC design.

In summary, this LAR revision addresses: 1) the elimination of grout in the GWC and the addition of processing the GWC through the use of vacuum drying and helium backfill; and 2) the design change of the PWC from a welded lid to a mechanically sealed lid. LAR 10-01, Revision 1, does not change or alter the process waste that was discussed in the original LAR 10-01.

4.0 TECHNICAL ANALYSIS

The sixth ISFSI cask is designed to store GTCC wastes, including wastes that are from activated metals or process wastes. The addition of process wastes to License Condition 7.B is within the design basis of the sixth ISFSI cask. There will be no impact on cask temperature and no significant impact on radiation dose. The process waste will have been thermally processed to remove organics and other hydrogen bearing components to reduce the potential for hydrogen generation during storage and eventual transport. The material will be dry to preclude corrosion during storage, and will be encapsulated in the PWC, a discrete container, to prevent co-mingling with the activated metal components.

5.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.41, PG&E has reviewed the environmental impact of the proposed amendment. An environmental assessment is included in Enclosure 4.

6.0 REFERENCES

6.1 Materials License No. SNM-2514 for the Humboldt Bay Independent Spent Fuel Storage Installation (TAC No. L23683), dated November 17, 2005

6.2 NRC Spent Fuel Project Office Interim Staff Guidance (ISG) – 17, "Interim Storage of Greater Than Class C Waste," dated November 6, 2001

6.3 PG&E Letter HIL-03-001, "License Application for Humboldt Bay Independent Spent Fuel Storage Installation," dated December 15, 2003

6.4 NRC Safety Evaluation Report, Enclosure 2 to NRC letter to PG&E dated November 17, 2005.

6.5 USNRC Information Notice 84-72, "Clarification of Conditions for Waste Shipments Subject to Hydrogen Gas Generation," dated September 10, 1984.

6.6 ANSI N14.5, "Radioactive Material-Leakage Tests On Packages For Shipment"

PROPOSED LICENSE CHANGE (MARK-UP)
CHANGES SHOWN IN BOLD AND ITALIC FONT

NRC FORM 588 U. S. NUCLEAR REGULATORY COMMISSION
(10-2000)
10 CFR 72

LICENSE FOR INDEPENDENT STORAGE OF SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter 1, Part 72, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, and possess the power reactor spent fuel and other radioactive materials associated with spent fuel storage designated below; to use such material for the purpose(s) and at the place(s) designated below; and to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified herein.

Licensee		
1. Pacific Gas and Electric Company	3. License No.	SNM-2514
	Amendment No.	2
2. Humboldt Bay Power Plant 1000 King Salmon Avenue Eureka, CA 95503	4. Expiration Date	November 17, 2025
	5. Docket or Reference No.	72-27

6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount That Licensee May Possess at Any One Time Under This License
A. Spent nuclear fuel from the Humboldt Bay Power Plant, Unit 3, and associated radioactive materials related to receipt, transfer and storage of the fuel assemblies.	A. Spent fuel assemblies as UO_2, clad with zirconium alloy. Damaged fuel assemblies, or fuel debris as UO_2, zirconium alloy cladding or stainless steel cladding contained in Damaged Fuel Containers.	A. 31 MTU of intact spent fuel assemblies, damaged fuel assemblies and fuel debris.
B. Greater Than Class C Waste; non-fuel related radioactive material generated as a result of reactor operation and decommissioning, where radionuclide concentrations exceed the limits of 10 CFR 61.55 for Class C Waste.	B. Greater Than Class C Waste, as activated metals ***and process wastes*** comprised of miscellaneous solid waste resulting from reactor operation and decommissioning.	B. 11 MT of Greater Than Class C Waste

9. Authorized Use: The material identified in 6.A., 6.B., 7.A. and 7.B., above is authorized for receipt, possession, storage and transfer using the HI-STAR HB dry cask storage system design as described in the Humboldt Bay ISFSI Safety Analysis Report dated December 15, 2003, as revised or supplemented on October 1, 2004, and as further supplemented and amended in accordance with 10 CFR 72.70 and 10 CFR 72.48.

10. Authorized Place of Use: The licensed material is to be received, possessed, transferred and stored at the Humboldt Bay ISFSI located on the Humboldt Bay Power Plant site in Humboldt County, California, near Eureka, California.

PROPOSED LICENSE CHANGE (RE-TYPED)

REMOVE PAGE	INSERT PAGE
Page 1 of 3	Page 1 of 3

NRC FORM 588 **U. S. NUCLEAR REGULATORY COMMISSION**
(10-2000)
10 CFR 72

LICENSE FOR INDEPENDENT STORAGE OF SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter 1, Part 72, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, and possess the power reactor spent fuel and other radioactive materials associated with spent fuel storage designated below; to use such material for the purpose(s) and at the place(s) designated below; and to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified herein.

Licensee	
1. Pacific Gas and Electric Company	3. License No. SNM-2514 Amendment No. 2
2. Humboldt Bay Power Plant 1000 King Salmon Avenue Eureka, CA 95503	4. Expiration Date November 17, 2025 5. Docket or Reference No. 72-27

6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount That Licensee May Possess at Any One Time Under This License
A. Spent nuclear fuel from the Humboldt Bay Power Plant, Unit 3, and associated radioactive materials related to receipt, transfer and storage of the fuel assemblies.	A. Spent fuel assemblies as UO_2, clad with zirconium alloy. Damaged fuel assemblies, or fuel debris as UO_2, zirconium alloy cladding or stainless steel cladding contained in Damaged Fuel Containers.	A. 31 MTU of intact spent fuel assemblies, damaged fuel assemblies and fuel debris.
B. Greater Than Class C Waste; non-fuel related radioactive material generated as a result of reactor operation and decommissioning, where radionuclide concentrations exceed the limits of 10 CFR 61.55 for Class C Waste.	B. Greater Than Class C Waste, as activated metals and process wastes comprised of miscellaneous solid waste resulting from reactor operation and decommissioning.	B. 11 MT of Greater Than Class C Waste

9. Authorized Use: The material identified in 6.A., 6.B., 7.A. and 7.B., above is authorized for receipt, possession, storage and transfer using the HI-STAR HB dry cask storage system design as described in the Humboldt Bay ISFSI Safety Analysis Report dated December 15, 2003, as revised or supplemented on October 1, 2004, and as further supplemented and amended in accordance with 10 CFR 72.70 and 10 CFR 72.48.

10. Authorized Place of Use: The licensed material is to be received, possessed, transferred and stored at the Humboldt Bay ISFSI located on the Humboldt Bay Power Plant site in Humboldt County, California, near Eureka, California.

ENVIRONMENTAL ASSESSMENT

Greater Than Class C Process Waste Background Information:

The Greater Than Class C (GTCC) process waste contained in the Process Waste Container (PWC) is thermally processed offsite at a vendor's facility. A dry heating process, known as dry-ashing, is designed to remove organics and other hydrogen bearing components from the process waste to produce a dry concentrated residue and to reduce the potential for hydrogen generation. The residue has sufficiently low enough hydrogen content to ensure that less than five percent by volume of hydrogen gas from radiolytic decomposition will be generated during long term storage or future transportation[1]. After the dry-ashing process is complete, the vendor vacuum dries the PWC, installs a mechanical seal, backfills the PWC with helium and conducts a leak test. The PWC will be returned to Humboldt Bay Power Plant (HBPP) and stored in the spent fuel pool (SFP) until it is loaded into the GTCC Waste Container (GWC). The GWC is placed within the HI-STAR HB Overpack and is similar to a Multi-Purpose Canister (MPC) within a HI-STAR HB spent fuel overpack and is designed to store GTCC waste. After loading the GTCC waste into the GWC, a lid will be placed on top of the GWC and will be welded shut using a process nearly identical to that performed on the spent fuel MPCs. The GWC will be vacuum dried, backfilled with helium and leak tested. The HI-STAR HB GTCC Overpack annulus is drained and a lid will be placed on top of the HI-STAR HB GTCC Overpack and will be bolted shut prior to transfer to, and long term storage in, the Humboldt Bay (HB) Independent Spent Fuel Storage Installation(ISFSI). The HI-STAR HB GTCC Overpack is structurally identical to the HI-STAR HB Overpacks which contain spent fuel.

Proposed Change:

The proposed license amendment will modify the existing license to allow storage of approximately 0.5 cubic feet (cu ft) of process waste which corresponds to approximately 150 pounds. The existing HB ISFSI includes approximately 390 spent fuel assemblies that weigh approximately 192 pounds each. Therefore, approximately 74,880 pounds of spent fuel is stored in the HB ISFSI. The storage of an additional 150 pounds (approximate) of GTCC process waste is not significant compared to the existing licensed storage of spent fuel on a mass basis.

In addition, the HB ISFSI is currently licensed to store the activated metal listed on Final Safety Analysis Report (FSAR) Table 3.1-3. The activated metals account for approximately 18 cu ft, while the process waste accounts for slightly greater than 0.5 cu ft.

[1] Criteria established by US-NRC Information Notice 84-72, "Clarification of Conditions for Waste Shipments Subject to Hydrogen Gas Generation."

Current License Environmental Assessment Information:

In October 2005 the NRC issued an Environmental Assessment regarding the construction and operation of the HB ISFSI. The Environmental Assessment included section 5.2, Radiological Impacts (page 19) and section 5.2.2, Accidents (page 21). Section 5.2 included a discussion of occupational dose and dose to the general public. The NRC reviewed the calculations and assumptions provided by PG&E. The NRC also performed confirmatory calculations to verify the source term and checked the dose rates. The NRC concluded that normal ISFSI operations would not have a significant onsite or offsite radiological impact based on the results of their review. Section 5.2.2 discussed normal, off-normal and accident events as defined in ANSI/ANS-57.9. None of the normal or off-normal events, except fire, resulted in any occupational or offsite radiological consequences. The effects of fire on the cask are not expected to result in significant offsite radiation doses. The NRC Environmental Assessment concluded that the construction, operation and decommissioning of the HB ISFSI would not result in a significant impact to the environment.

The radiation dose consequence associated with the proposed change to add process waste to one cask, as described in this license amendment request (LAR), is bounded by the results of the above analysis regarding onsite and offsite dose.

HB ISFSI FSAR Section 7.2.2 states "The all-welded construction of the MPC in conjunction with the extensive inspections and testing performed during closing operations ensures that no release of radioactive effluents will occur from the HI-STAR HB System. HB ISFSI FSAR Section 7.7 concludes that no radioactive gas, liquid or solid waste effluents are released from the HB ISFSI during operation.

Environmental Assessment:

The following Environmental Assessment has been developed by responding to appropriate questions that pertain to ensuring that protection of the environment, the public and plant workers is maintained as a result of the changes proposed in LAR 10-01, Revision 1.

1. Describe any change to the types, characteristics, or quantities of non-radiological effluents discharged to the environment as a result of the proposed license amendment.

   There are no changes in the types, characteristics, or quantities of non-radiological effluents discharged to the environment associated with this proposed license amendment. The addition of process waste will not change the FSAR statements.

2. Describe any changes to liquid radioactive effluents discharged as a result of the proposed license amendment.

There are no liquid radioactive effluents from the HB ISFSI and there are no expected changes to the liquid radioactive effluents that will result from the proposed license amendment. The proposed license amendment will not result in changes to the design basis requirements for the SSCs at the HB ISFSI related to liquid radiological effluents. The addition of process waste will not change the FSAR statements.

3. Describe any changes to gaseous radioactive effluents discharged as a result of the proposed license amendment.

   There are no gaseous radioactive effluents from the HB ISFSI and there are no expected changes to the gaseous radioactive effluents that will result from the proposed license amendment. The proposed license amendment will not result in changes to the design basis requirements for the structure, systems, and components (SSCs) at the HB ISFSI that function to limit the release of gaseous radiological effluents during and following postulated accidents. The addition of process waste will not change the FSAR statements.

4. Describe any change in the type or quantity of solid radioactive waste generated as a result of the proposed license amendment.

   There are no changes in the type or quantity of solid radioactive waste generated as a result of the proposed license amendment. The proposed license amendment will not result in changes to the design basis requirements for the SSCs at the HB ISFSI that function to limit the release of solid radiological waste during and following postulated accidents. The addition of process waste will not change the FSAR statements.

5. What is the expected change in occupational dose as a result of the proposed license amendment under normal and design basis accident conditions?

   Under normal operation there would be no expected radiological impact on either the workforce or the public. There are no other expected changes in normal occupational operating doses that will result from the proposed license amendment. The cask storage location at the HB ISFSI is below grade. The dose from the addition of process waste to the one remaining cask is bounded by the radiological dose analysis for the HB ISFSI.

6. What is the expected change in the public dose as a result of the proposed license amendment under normal and design basis conditions?

   Dose to the public during normal operations will not be changed by the proposed license amendment. The radiation dose consequence associated with the proposed change of adding process waste to one cask, as described in this LAR, is bounded by the results of the above analysis regarding onsite and offsite dose.

7. What is the impact to land disturbance for the proposed license amendment?

   The proposed amendment pertains to the type of GTCC waste stored in a GTCC cask. The proposed amendment will not change the land disturbance associated with the HB ISFSI. None of the proposed changes associated with this license amendment involve areas known to have cultural or historical significance.

Conclusion:

There is no significant radiological environmental impact associated with the proposed license amendment at the HB ISFSI. The proposed changes will not affect any historical sites nor will they affect non-radiological plant effluents. Accordingly, PG&E requests that the NRC issue and publish a finding of no significant environmental impacts pursuant to 10 CFR 51.32 and 10 CFR 51.35.

ADDITIONAL TECHNICAL INFORMATION

The following information summarizes information previously submitted to the NRC in PG&E Letters HIL-11-002 and HIL-11-006 that responded to NRC Requests for Supplemental Information (RSIs) and Request for Additional Information (RAI), updated to reflect the revised GTCC Waste Container (GWC) design, processing plans and Process Waste Container (PWC) design.

INTRODUCTION

The purpose of this Introduction is to provide a general description of the manner in which the Greater Than Class C (GTCC) waste will be stored. Humboldt Bay (HB) Independent Spent Fuel Storage Installation (ISFSI) Drawing DSK-RXV-037, provided in Attachment 1 to this Enclosure, illustrates the configuration of the GTCC Overpack Assembly (referred to as the GTCC cask elsewhere in this Enclosure) and the stainless steel internal container, referred to as the Process Waste Container (PWC) that will contain GTCC process waste.

The GTCC process waste has been stored wet in Interim Storage Container-18 (ISC-18) in the Humboldt Bay Power Plant (HBPP) spent fuel pool (SFP). The GTCC process waste has been transferred underwater from ISC-18 to a vendor-provided PWC. The vendor shipped the process waste to their offsite facility for thermal processing. A dry heating process, known as dry-ashing, is designed to remove organics and other hydrogen-bearing components from the process waste to produce a dry concentrated residue. The residue will have sufficiently low enough hydrogen content to ensure that less than five percent (5%) by volume of hydrogen gas from the radiolytic decomposition will be generated during long term storage or future transportation[1]. The vendor then vacuum dries the PWC, installs a mechanical seal, backfills the PWC with helium and conducts a leak test prior to shipping the PWC back to the HBPP SFP for eventual loading into the GTCC cask.

As shown in Attachment 1, the GTCC cask contains a container referred to as the GTCC Waste Container (GWC). The GWC is equivalent to the Multi-Purpose Canister (MPC) within a spent fuel cask. Also shown in Attachment 1 the GWC includes an Outer Container that is welded onto the bottom of the GWC. The Outer Container is initially open on the top to allow placement of the PWC. The Outer Container is designed to receive the PWC and provide stabilization for the PWC during storage and transportation.

1 Criteria established by US-NRC Information Notice 84-72, "Clarification of Conditions for Waste Shipments Subject to Hydrogen Gas Generation."

The GTCC cask containing the GWC will be placed in the SFP in preparation for loading. The PWC will be placed within the outer container on the bottom of the GWC, and an outer container lid will be installed. Then the GTCC activated metals will be loaded into the GWC. Next, the GWC will be drained, vacuum dried and back filled with helium.

The loading sequence of the GTCC cask is summarized as follows:

- The GTCC cask (including the GWC) will be placed inside the SFP.
- The PWC will be placed in the outer container inside the GWC within the GTCC cask. (NOTE – The PWC will be loaded into the cask in a wet environment; however, the interior of the stainless steel PWC, which contains the process waste, will have been thermally processed, vacuum dried, backfilled with helium and leak tested at the vendor's site prior to being returned to HBPP)
- A lid will be placed over the outer container
- The GTCC activated metals will be placed inside the GWC.
- The GWC lid will be set on the GWC
- The GTCC cask will be lifted out of the SFP and placed within the refueling building.
- The GWC will be drained.
- The GWC lid will be welded to the shell.
- The GWC will be vacuum dried, backfilled with helium and leak tested
- A lid will be placed on top of the HI-STAR HB GTCC cask and bolted shut.

<u>TECHNICAL INFORMATION</u>

Structural and Materials
Clarification of the weight consideration regarding maximum GTCC weight limit of 11 MT(from RSI-1 RESPONSE HIL-11-002 PAGE 2)

PG&E will use one discrete PWC. This discrete PWC, including PWC filler materials, is part of the weight consideration in meeting the maximum GTCC weight limit of less than 11 MT. The volume of the process waste material is slightly greater than 0.5 cubic feet, corresponding to an approximate weight of 150 lbs. The estimated weight of the GTCC activated metals waste is less than 2 MT. The weight of all GTCC wastes is well below the license condition limit of 11 MT.

Structural and Materials
Insufficient description of encapsulating the GTCC waste in discrete containers.
(from RSI-1 (CONTINUED) RESPONSE HIL-11-002 PAGE 2 AND 3)

The GTCC process waste will be thermally processed offsite at a vendor's facility to remove organics and other hydrogen bearing components from the process waste to produce a concentrated residue. The residue has sufficiently low enough hydrogen content to ensure that less than five percent by volume of hydrogen gas from the radiolytic decomposition will be generated during long-term storage and transportation. The process waste, in the form of a powder, will be returned to the HBPP SFP inside a single, dry, mechanically sealed, stainless steel container that is backfilled with helium, leak tested and referred to as the PWC. The PWC will be placed within an "Outer Container" that is welded onto the bottom of the GWC within the GTCC cask. The "Outer Container" restricts movement of the PWC, although the process waste, which is in the form of a powder, may move within the PWC. After the GTCC activated metals are loaded into the GWC, the GWC will be seal welded, drained, vacuum dried, backfilled with helium and leak tested.

The GTCC cask is structurally identical to the HB ISFSI spent fuel casks. The structural performance of the GTCC cask is enveloped by the structural analysis performed for the spent fuel casks. The weight of an MPC loaded with spent fuel is approximately 59,000 pounds (lbs). The weight of the GWC loaded with GTCC waste is approximately 30,000 lbs. The GWC contains approximately 4,000 lbs. of GTCC waste. The GTCC activated metal will be cut and placed within the GWC in an evenly distributed manner. As a result, the weight of the loaded GWC will be evenly distributed and will be less than the weight of a loaded MPC. Thus, the overall weight of the GTCC cask will be less than the weight of a loaded spent fuel cask.

HB ISFSI Drawings DSK-RXV-037 and DSK-RXV-042, provided in Attachment 1 to this Enclosure, illustrates the configuration of the GTCC cask (overpack assembly), the GWC and the PWC. The PWC is a stainless steel welded container approximately 12 inches in diameter and 24 inches high.

The PWC lid will incorporate features for vacuum drying and helium backfilling. The PWC lid will have a Swagelok fitting for vacuum drying and helium backfilling, and a threaded cap (mechanical seal) that will be installed over the Swagelok fitting.

Using the PWC lid's Swagelok fitting and a suitable vacuum drying system, the PWC will be evacuated to 3 torr and held for 30 minutes. The PWC will then be backfilled with helium and leak tested. The PWC delivered to HBPP will be fully sealed and suitable for placement into the SFP for temporary storage prior to placement inside the GWC.

The PWC will be placed within the outer container, see Attachment 1, inside the GWC. The Outer Container is designed to provide stabilization for the PWC. A lid will be placed on the outer container. Activated metals will be placed outside the outer container and on the outer container lid. The PWC and the outer container provide barriers to prevent the process waste from co-mingling with the GTCC activated metals.

Structural and Materials
Provide a detailed description of the various items that will constitute the GTCC waste (FROM RSI-2 RESPONSE HIL-11-002 PAGE 3 AND 4)

The GTCC process waste has been stored in ISC-18 located in the SFP. The contents of ISC-18 consist of the vacuumed residue from cleanup of the SFP, including Special Nuclear Material (SNM) waste and the remains of filters and resin. The material consists of distributed and particulate SNM waste mixed with resins, metallic oxides, and small Stellite particles. The total activity is 4.85E+4 mCi, of which there are 18.3 grams of SNM waste.

Table 1, below, identifies the nuclides contained in the process waste.

TABLE 1
PROCESS WASTE RADIONUCLIDES

RADIONUCLIDE	ACTIVITY (mCi)	RADIONUCLIDE	ACTIVITY (mCi)
Am-241	2.30E+2	Pu-242	2.70E-1
Pu-239	2.28E+2	Ni-63	1.44E+2
Pu-238	2.26E+2	Eu-154	3.24E-1
Pu-240	2.03E+2	Tc-99	2.20E-2
Pu-241	5.45E+3	C-14	5.02E-3
Co-60	2.78E+4	H-3	5.80E-3
Cs-137	1.39E+4	U-238	3.10E-1
Cm-243	4.28E+0	U-235	2.99E-2
Cm-244	4.27E+0	I-129	1.71E-4
Sr-90	3.37E+2	Total	4.85E+4

Table 2, below, identifies the Waste Classification of the process waste

Table 2

Waste Classification Table

Isotope	**Concentration Ci/m^3**	**Class A Limit Ci/m^3**	**Class A Fraction**	**Class B Limit Ci/m^3**	**Class B Fraction**	**Class C Limit Ci/m^3**	**Class C Fraction**
C-14	3.41E-04	0.8	0.0004	----	----	8	0
Tc-99	1.49E-03	0.3	0.005	----	----	3	0.0005
I-129	1.16E-05	0.008	0.0015	----	----	0.08	0.001
Pu-241*	1.06E+05	350	302.2	----	----	3500	30.2
Other TRU*	1.74E+04	10	1737.307	----	----	100	173.731
Sum of Fractions			**2039.970**	**----**			**203.997**
H-3	3.95E-04	40	0	----	----	----	----
Co-60	1.90E+03	700	2.710	----	----	----	----
Ni-63	9.76E+00	35.0	0.279	700	0.014	7000	0.001
Sr-90	2.29E+01	0.04	571.962	150	0.153	7000	0.003
Cs-137	9.45E+02	1.000	944.563	44	21.467	4600	0.205
T1/2<5 yrs	0.00E+00	700	0	----	----	----	----
Sum of Fractions			**1519.514**		**21.643**		**0.21**

* Units are nCi/gm

The process waste will be stored in a dry, mechanically sealed, stainless steel container and will be vacuum dried, backfilled with helium and leak tested. Therefore, the process waste is prevented from co-mingling with the GTCC activated metals.

Structural and Materials

Discuss other possible environmental aspects such as radiation field and discuss whether the waste will be loaded wet… (FROM RSI-2 (CTD) IN HIL-11-002 PAGE 4 AND 5)

The GTCC process waste will be thermally processed offsite at a vendor's facility A dry heating process will remove organics and other hydrogen bearing components from the process waste to produce a concentrated residue The residue has sufficiently low enough hydrogen content to ensure that less than five percent by volume of hydrogen gas from radiolytic decomposition will be generated during long-term storage and transportation. Upon completion of the processing, the final product of the waste will be dry, in solid form (a powder). The process waste will be returned to the HBPP SFP inside a single, dry, helium backfilled, stainless steel, container, referred to as the PWC. The PWC will be loaded into the GWC in the SFP, a wet environment; however, the process waste contained within the PWC will remain dry during the loading. As a result, the process waste contained within the PWC will be totally isolated from the SFP, the GWC and the GTCC activated metals. The barrier provided by the PWC mitigates the potential of chemical or galvanic induced adverse reactions.

After the process waste has been loaded into the GWC, the activated metals will be loaded into the GWC. The GWC will be moved out of the SFP, drained, vacuum dried, and back filled with helium.

During the loading sequence and ultimate storage in the ISFSI, radiolytic decomposition or other breakdown of the process waste will not be an issue because the residue has sufficiently low enough hydrogen content to ensure that less than five percent by volume of hydrogen gas from the radiolytic decomposition will be generated during long-term storage and transportation. Additionally, the process waste inside the PWC will be physically isolated from reactor-produced activated metals stored in the GWC. Therefore, no chemical or galvanic induced adverse reactions will occur.

Shielding
Revise SAR to include a description of the process wastes to be stored in the ISFSI
(FROM RSI-1 SHIELDING IN HIL-11-002 PAGE 5)

PG&E proposes to revise Final Safety Analysis Report (FSAR) Table 3.1-3 by adding a single line entry at the bottom to provide the same level of detail for the process wastes that is currently provided for activated metals. Enclosure 6 to this License Amendment Request contains the proposed change to FSAR Table 3.1-3 shown with a revision bar in the margin.

Regarding the question of location and configuration of the GTCC waste container with respect to the spent fuel storage casks, FSAR Section 3.1.1.4 provides a physical description, and FSAR Figure 3.2-1, Sheet 4 of 5, depicts the location and configuration. Section 3.1.1.4 states "GTCC is stored in a separate cask from spent fuel in accordance with 10 CFR 72.120(b)(1). There are no criticality issues associated with the storage of GTCC waste."

Provide a brief description of the process of sealing the GTCC cask
(FROM RAI-2 HIL-11-006 PAGE 5)

Overall GWC construction meets ISG-18 as described in FSAR Table 4.2.3. The welding of the GWC closure lid is identical to that performed on the spent fuel MPCs described in FSAR Section 4.2.3.2.1.

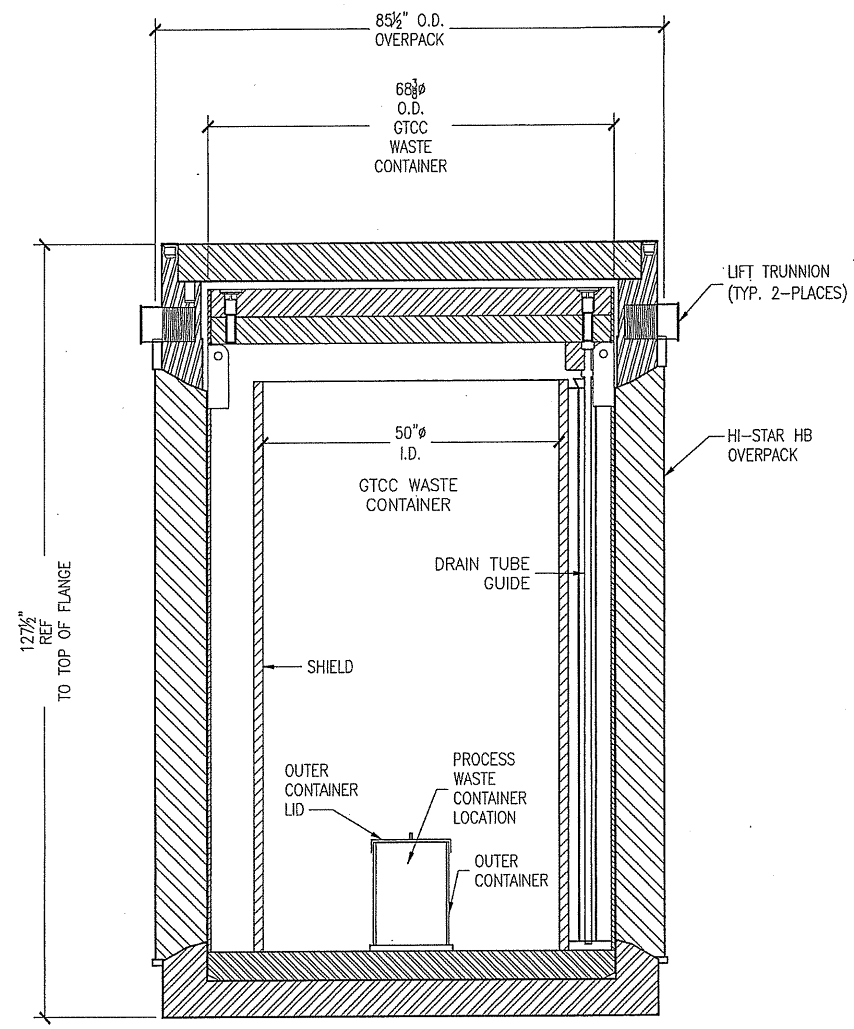
Although no combustible gas is expected, the space under the GWC lid is exhausted or purged during welding operations to prevent combustible gas concentrations from accumulating. Appropriate monitoring for combustible gas concentration is performed prior to and during GWC lid welding operations. The GWC lid-to-shell weld is then completed, including liquid penetrant inspections after the root pass, each approximately 3/8-inch of weld depth, and after the final pass.

Once the lid-to-shell weld is complete, Removable Valve Operating Assemblies (RVOAs) are installed and the GWC undergoes a pressure test for leaks in accordance with the ASME Code. The lid-to-shell weld is liquid penetrant inspected after the pressure test. Either prior to, or following successful completion of the pressure test (depending on whether a hydrotest or pneumatic test is performed), appropriate hoses are installed and the remaining GWC water is displaced from the GWC by pumping or blowing pressurized nitrogen or helium gas into the GWC.

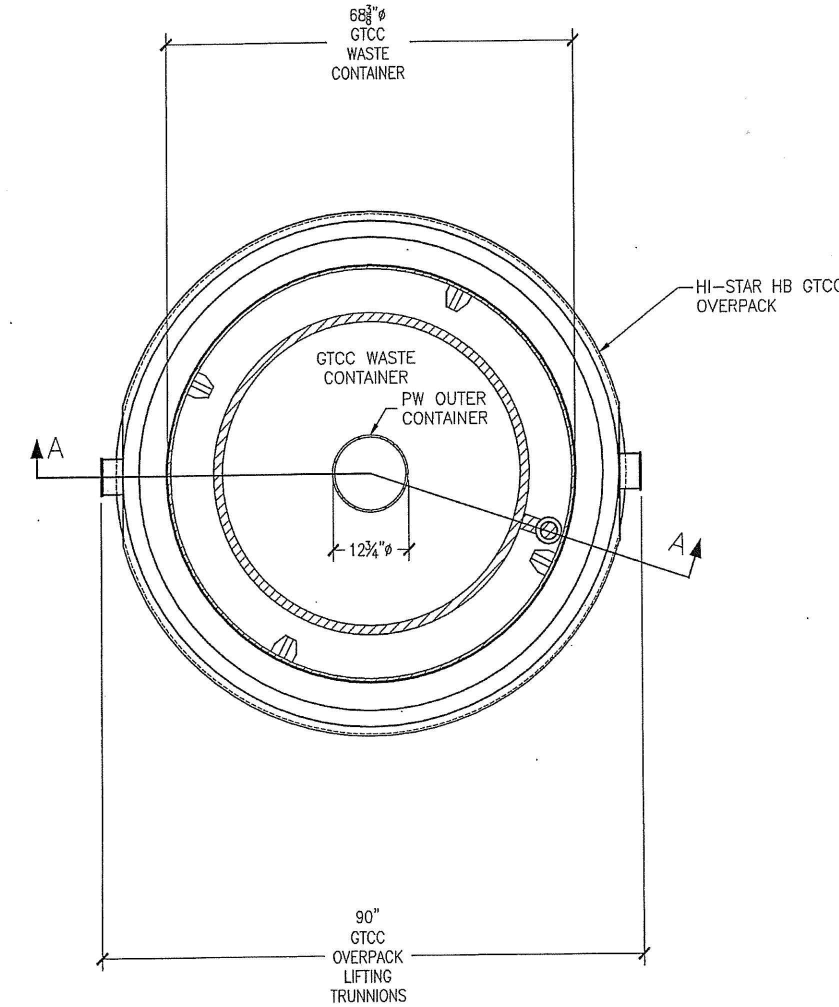
The water is drained from the overpack annulus and vacuum drying is used to remove the remaining liquid water from the GWC and to ultimately reduce the moisture content of the MPC cavity to an acceptable level.

Following the successful completion of moisture removal from the GWC, the GWC is backfilled with helium to a nominal pressure range of 10 to 15 pounds per square inch, gage. Helium backfill provides an inert atmosphere to ensure long-term waste integrity. After successful helium backfill operations, the RVOAs are removed and the GWC vent and drain port cover plates are installed, welded, and examined. The GWC closure ring is then installed, welded, and examined.

For a more complete description please see HB ISFSI FSAR section 5.1.1.5 Cask Loading and Sealing Operations (Enclosures 6 and 7).



SECTION A – A



TOP VIEW
N.T.S.

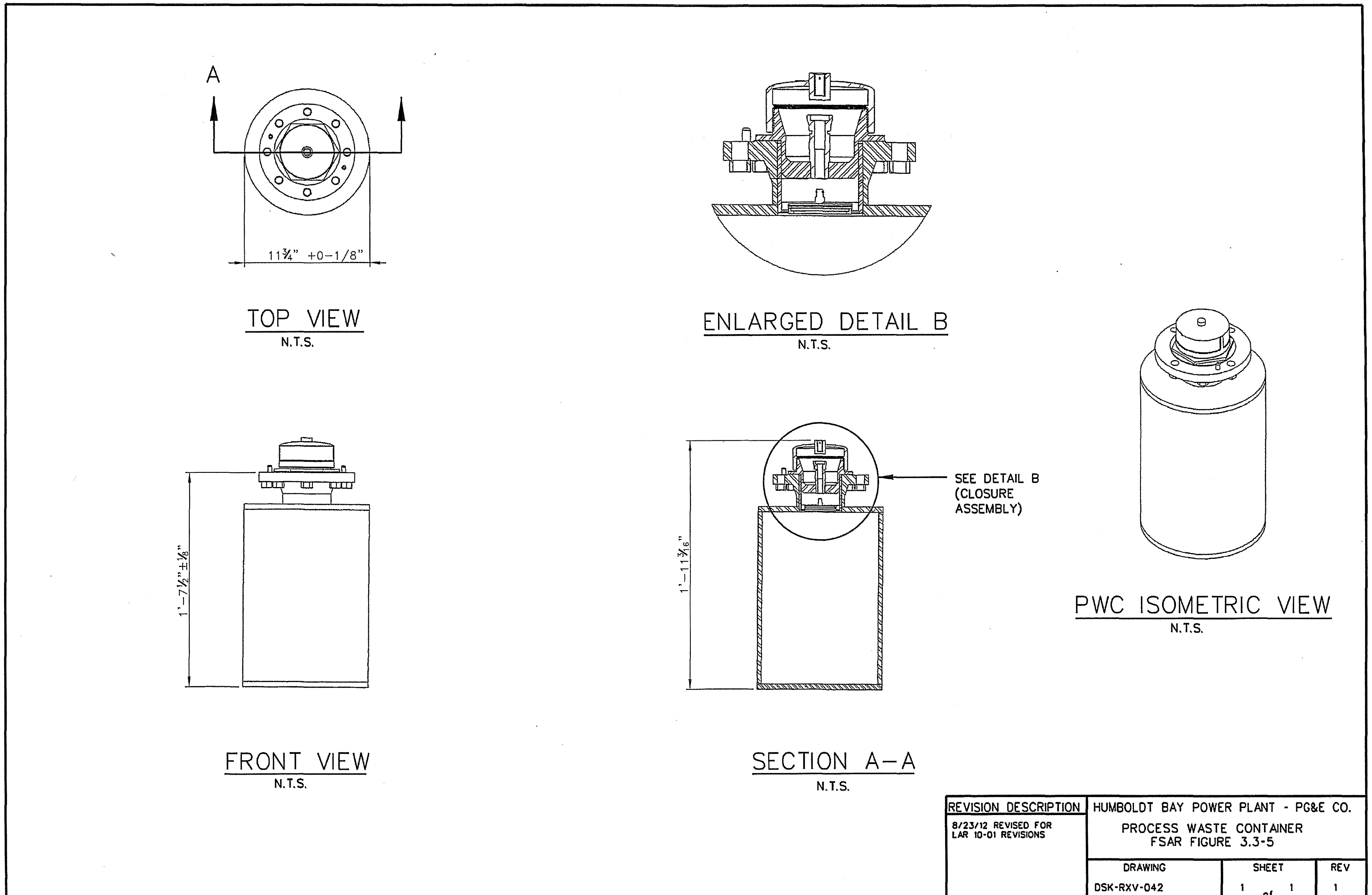
GTCC CASK ASSEMBLY
N.T.S.

NOTE:
1.) CLOSURE LIDS NOT SHOWN IN TOP VIEW FOR CLARITY.

KEY:

STEEL

REVISION DESCRIPTION	HUMBOLDT BAY ISFSI GTCC CASK ASSEMBLY OVERVIEW FSAR FIGURE 3.3–4		
8/23/12 REVISED FOR LAR 10–01 REVISION 1	DRAWING	SHEET	REV
	DSK–RXV–037	1 of 1	1


A
11¾" +0-1/8"
TOP VIEW
N.T.S.
ENLARGED DETAIL B
N.T.S.
PWC ISOMETRIC VIEW
N.T.S.
1'-7½"±⅛"
FRONT VIEW
N.T.S.
1'-11 3/16"
SEE DETAIL B
(CLOSURE
ASSEMBLY)
SECTION A-A
N.T.S.
REVISION DESCRIPTION
8/23/12 REVISED FOR
LAR 10-01 REVISIONS
HUMBOLDT BAY POWER PLANT - PG&E CO.
PROCESS WASTE CONTAINER
FSAR FIGURE 3.3-5
DRAWING
DSK-RXV-042
SHEET
1 of 1
REV
1

PROPOSED CHANGES TO FSAR SECTIONS 3.1, 4.5 AND 5.1 (MARK-UP)

CHANGES ARE SHOWN IN BOLD ITALIC FONT FOR ADDITIONS AND STRIKE-THROUGHS FOR DELETIONS

3.1 PURPOSES OF INSTALLATION

The Humboldt Bay Independent Spent Fuel Storage Installation (ISFSI) is designed for interim, dry, and below ground vault storage of intact and damaged spent nuclear fuel assemblies, and reactor-related greater than class C (GTCC) waste from Humboldt Bay Power Plant (HBPP) Unit 3. The ISFSI uses the Holtec International HI-STAR HB storage system, as discussed in Section 1.1.

The material from the HBPP spent fuel pool is sealed in multi-purpose canisters custom-designed for HBPP fuel (MPC-HBs), and the MPCs are stored in HI-STAR HB storage/transportation overpacks in a reinforced concrete vault. The ISFSI is designed to store up to 400 spent fuel assemblies in five casks, with a sixth cask to store GTCC waste.

Each MPC-HB can store up to 80 spent nuclear fuel assemblies. Each MPC-HB is also capable of storing 80 damaged fuel containers (DFCs), of which 28 or 40, depending on the loading pattern, can contain damaged fuel as needed to store the entire HBPP spent fuel inventory at the ISFSI.

3.1.1 MATERIAL TO BE STORED

The materials to be stored at the ISFSI consist of intact fuel assemblies, damaged fuel assemblies, and GTCC waste. The fuel assemblies may be stored with, or without channels. There are 390 fuel assemblies in the HBPP inventory, and a quantity of loose debris that could constitute an equivalent of one additional assembly. Each fuel assembly contains approximately 192 pounds (87 kg) of UO_2. Damaged fuel is stored in a damaged fuel container (DFC) in an MPC-HB in accordance with ISG-1, Revision 1 (Reference 1). Damaged fuel in the form of loose fuel rods, fuel pellets, etc. can be consolidated; however, The amount of fuel debris in a single DFC is limited to the total fissile material and weight of a single intact fuel assembly. The loose debris may be stored in one or two DFCs to optimize the retrieval and handling operations.

Video inspection of the Humboldt Bay spent fuel assemblies was conducted in 2000-2001 using the guidance of ISG-1 Revision 0, Nuclear Energy Institute comments on ISG-1, and the definitions of damaged fuel and fuel debris contained in the Holtec HI-STAR 100 Certificate of Compliance (CoC). Eleven fuel assemblies were initially classified as damaged and 16 were classified as fuel debris. A supplemental evaluation of the 2000-2001 video records will be performed prior to fuel loading using the guidelines in Table 3.1-1, which meets the intent of ISG-1 Revision 1.

Discussed herein are the characteristics of these materials and how the HI-STAR HB storage system design criteria envelopes these characteristics.

3.1.1.1 Physical Characteristics

The spent fuel assemblies to be stored consist of General Electric Type II (a 7 x 7 array of fuel rods), General Electric Type III, Exxon Type III, and Exxon Type IV (a 6 x 6 array of fuel rods) fuel assemblies. Construction details for each type are similar (References 2 through 5). The main support structure for an assembly consists of fuel rods used as tie rods between upper and lower tie plates. All assemblies use three spacer grids attached to a single spacer capture rod to maintain fuel rod spacing. The licensing basis fuel cladding material for all assemblies is any zirconium-based alloy, consistent with the HI-STAR 100 System CoC. Fuel records indicate that all HBPP fuel cladding material for intact and damaged assemblies is Zircaloy-2. Channels are fabricated from Zircaloy material. The loose fuel debris described in Section 3.1.1 may have either Zircaloy cladding, stainless steel cladding, or may be unclad pellets. A summary of the physical characteristics of the Humboldt Bay fuel proposed for storage at the ISFSI is shown in Table 3.1-2.

Fuel records have been maintained to identify the configuration and initial enrichment of each fuel assembly. Each fuel assembly is identified with a unique identification number. Each assembly will be recorded as to its cask loading location.

3.1.1.2 Thermal and Radiological Characteristics

The thermal and radiological characteristics of the HBPP fuel to be stored are summarized below, and constitute limiting values for storage of fuel assemblies at the Humboldt Bay ISFSI. The values listed below were used in the analyses supporting the design and bound the actual values for these parameters for the entire HBPP spent fuel inventory to provide margin. All loose fuel debris is bounded by these parameters.

(1) Heat Generation

The maximum permitted heat generation rate for a single assembly that is stored at the Humboldt Bay ISFSI is 50 watts. The maximum total heat load for a single cask is 2000 watts.

(2) Fuel Burnup

The maximum average fuel burnup per assembly of any fuel that is stored at the ISFSI is 23,000 MWD/MTU.

(3) Cooling Time

The minimum cooling time of any fuel that is stored at the ISFSI is 29 years at the time of the first fuel loading in the ISFSI.

(4) Enrichment

The maximum planar-average enrichment for any one fuel assembly is 2.60 wt. % ^{235}U.

The minimum planar-average enrichment for any one fuel assembly is 2.08 wt. % ^{235}U.

(5) External Condition

The fuel cladding surface is fairly uniformly coated with a crud layer, which appears to be primarily oxide from the carbon steel piping system. The actual thickness of the oxide has not been determined. However, NUREG 0649 states that typically, the oxide buildup on BWR pins is on the order of 25 to 100 microns and in the form of FE_2O_3. The NUREG further states that a calculation was made to determine whether a 100 micron buildup would affect heatup of the pins during a pool drainage accident, and found that the overall effect on pin temperature was less that one degree. There are several assemblies that have additional loose crud material attached.

3.1.1.3 Non-fuel Hardware and Neutron Sources

No non-fuel hardware or neutron sources are to be stored at the Humboldt Bay ISFSI.

3.1.1.4 Greater Than Class C Waste

Table 3.1-3 lists neutron activated components and ***process waste*** materials at HBPP that may potentially be classified as GTCC and stored at the ISFSI. ***The activated metals*** have been placed on this list due to close proximity to the reactor core (e.g., within approximately 12 inches of active fuel) and exposure to a peak core thermal neutron flux of slightly greater than 1×10^{13} neutrons/sec/cm^2 during 13 years of reactor operation. The actual quantity of ***activated metals*** may be less than that listed, due to the conservatism used in this assumption. An accurate classification of this waste material will be performed prior to loading into the GTCC ***Waste Container (GWC)***.

The process waste material was generated during cleanup of the spent fuel pool. The material consists of distributed and particulate SNM waste mixed with resins, metallic oxides, and small Stellite particles. The total activity is 4.85E+4 mCi, of which there are 18.3 grams of SNM waste. After thermal processing, the process waste material will be in the form of a dry concentrated residue.

As shown on Figure 3.3-4, the GWC is contained within the HI-STAR HB GTCC Overpack. The GWC is similar to the Multi-Purpose Canister (MPC) within a spent fuel cask. Also shown is the Outer Container that is welded onto the bottom of the GWC. The process waste will be contained in a Process Waste Container

(PWC), shown on Figure 3.3-5. The PWC is a stainless steel, cylindrical container, approximately 12 inches in diameter and 24 inches high and will be mechanically sealed, vacuum dried, backfilled with helium and leak tested. The PWC will be placed within the Outer Container inside the GWC. The Outer Container is designed to provide stabilization for the PWC. A lid will be placed on top of the Outer Container. The activated metals will be placed inside the GWC and outside of the Outer Container. Therefore, the process waste is prevented from co-mingling with the GTCC activated metals.

After loading the GTCC waste into the GWC, a lid will be placed on top of the GWC and will be welded to the shell. The GWC will be vacuum dried, backfilled with helium and leak tested. Then a lid will be placed on top of the HI-STAR HB GTCC Overpack and bolted shut.

The radiation dose ***at the surface of the HI-STAR HB GTCC Overpack*** is bounded by that assumed in the analysis performed for a HI-STAR HB spent fuel overpack. GTCC is stored in a separate cask from spent fuel in accordance with 10 CFR 72.120(b)(1). There are no criticality ***or decay heat*** issues associated with the storage of GTCC waste.

3.1.2 REFERENCES

1. Interim Staff Guidance 1, <u>Damaged Fuel</u>, USNRC, Revision 0, May 1999 and Revision 1, October 2002.

2. General Electric Drawing GE 731E272 (GE Type II Fuel Assembly), PG&E Drawing #6019924, Sheet 13.

3. General Electric Drawing GE 731E228 (GE Type III Fuel Assembly), PG&E Drawing #6019924, Sheet 14.

4. Exxon Nuclear (Jersey Nuclear) Drawing Nuclear R-1330 (Exxon Type III Fuel Assembly), PG&E Drawing #6019924, Sheet 15.

5. Exxon Nuclear Drawing XN 300.900 (Exxon Type IV Fuel Assembly), PG&E Drawing #6019924, Sheet 16

HUMBOLDT BAY ISFSI FSAR UPDATE TABLE 3.1-3

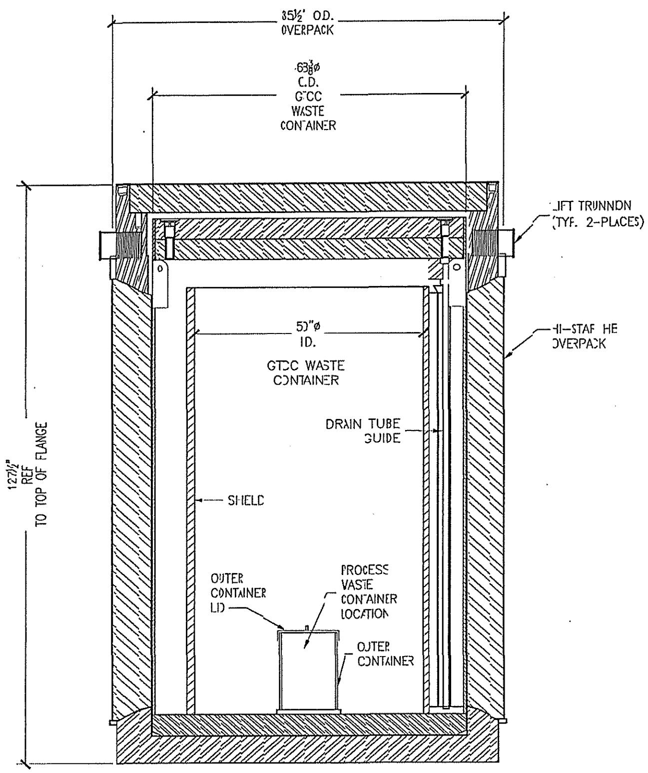
POTENTIAL GREATER THAN CLASS C WASTE

GTCC Description	Quantity	Approximate Individual Item Size	Estimated Total Volume	Material
Rollers punched from control rod blades and control rod followers	~~312~~*400*	Cylindrical 1" dia x 1/2" h	~~0.07~~*0.09* ft^3	Stellite
Miscellaneous loose hardware from fuel assemblies - cap screws, lock washers, spring clips, spacers and compression springs	Unknown	Small	<0.10 ft^3	304 Stainless Steel, Inconel-X
~~Non Special Nuclear Material (SNM) portions of in-core fission strings~~ *Incore Thermocouple Tube*	~~24~~ *1*	~~3/8" O.D. 18" to 30" long~~ *¾" ODx16ft long*	<0.03 ft^3	304 Stainless Steel
~~Rollers to be removed from control rod blades still in the reactor vessel~~	~~256~~	~~Cylindrical 1" dia x 1/2" h~~	~~0.06 ft^3~~	~~Stellite~~
Internal removable core support plates (4 fuel assemblies each)	32	10.375" x 10.466" x 1"	2.0 ft^3	ASTM A351-58T, Grade CF-8 304 Stainless Steel
Fuel support plate - 12 holes	4	Irregular (Semi-circular) (48" largest dimension)	1 ft^3	ASTM A351-58T, Grade CF-8 304 Stainless Steel
Fuel support plate - 3 holes	4	Irregular (Semi-circular) (16" largest dimension)	0.35 ft^3	ASTM A351-58T, Grade CF-8 304 Stainless Steel

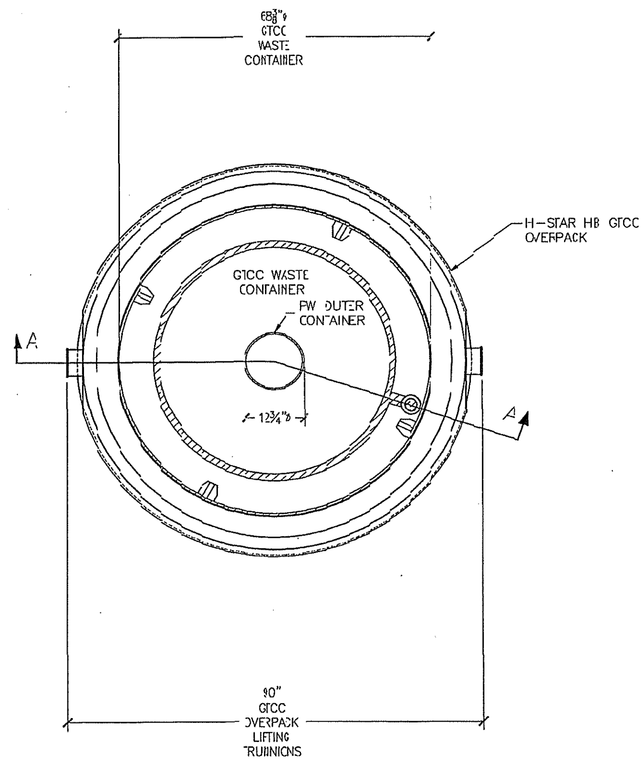
GTCC Description	Quantity	Approximate Individual Item Size	Estimated Total Volume	Material
Flux monitor socket	8	2-3/4" x 4-1/2" x 6"	0.35 ft^3	304 Stainless Steel
Socket –***Lower Core Support, intersection of beams and rods***	37	Cylindrical 1-3/4" dia x 2-1/2" h	0.13 ft^3	304 Stainless Steel
Beam - Core Support	2	3/8" x 4-1/2" x 58"	0.12 ft^3	304 Stainless Steel
Beam - Core Support	4	3/8" x 4-1/2" x 37"	0.15 ft^3	304 Stainless Steel
Beam - Core Support	2	3/8" x 4-1/2" x 31"	0.06 ft^3	304 Stainless Steel
Beam - Core Support	4	3/8" x 4-1/2" x 20"	0.08 ft^3	304 Stainless Steel
Beam - Core Support	2	3/8" x 4-1/2" x 40"	0.08 ft^3	304 Stainless Steel
Beam - Core Support	1	3/8" x 4-1/2" x 19"	0.02 ft^3	304 Stainless Steel
Rod - Core Support	4	3/8" O.D. x 45"	0.012 ft^3	304 Stainless Steel
Rod - Core Support	2	3/8" O.D. x 40"	0.006 ft^3	304 Stainless Steel
Rod - Core Support	4	3/8" O.D. x 41"	0.011 ft^3	304 Stainless Steel
Rod - Core Support	4	3/8" O.D. x 32"	0.009 ft^3	304 Stainless Steel
Rod - Core Support~~)~~	8	3/8" O.D. x 22"	0.012 ft^3	304 Stainless Steel
Rod - Core Support~~)~~	4	3/8" O.D. x 19"	0.005 ft^3	304 Stainless Steel

GTCC Description	Quantity	Approximate Individual Item Size	Estimated Total Volume	Material
Rod - Core Support	4	3/8" O.D. x 11"	0.003 ft^3	304 Stainless Steel
Miscellaneous hardware for core support assembly (u-bolts, bolts, screws, nuts, dowel pins, groove pins and safety wire)	Various	small	< 0.1 ft^3	304 Stainless Steel
Rim ***of Upper Shroud***	1	86" O.D. x 82-1/2" I.D.	1.0 ft^3	304 Stainless Steel
Cylinder (part of ***upper*** core shroud - surrounds the reactor core) - includes miscellaneous associated hardware (blocks, locating pins, gussets, etc.)	1	96" O.D. x 95-3/8" h x 1/4" thick	4.5 ft^3	304 Stainless Steel
~~Core hold down~~ ***Chimney clamps and support brackets*** (includes all associated hardware and components)	8	~~5" x 11" x 1-1/2"~~ ***Irregular 6"x12"x8"***	~~0.40~~***0.93*** ft^3	304 Stainless Steel, Inconel-X
Lower portion of fuel hold down at the top of the core	45	Pipe: 1-1/2" O.D. x 3 ft. Latch: 1/2" x 1-1/2" x 4-1/4"	1.8 ft^3	304 Stainless Steel
Portions of ***Lower Core*** support ring ~~(below the core in close proximity) and chimney (above the core in close proximity)~~	Various	Cut to fit	~~5.0~~***2.9*** ft^3	304 Stainless Steel
Upper Core Guide (Chimney base plate and grid former)	***Various***	***Cut to fit***	***2.1 ft^3***	***304 Stainless Steel***
Specimen baskets, specimens and associated hardware (RPV Shell Surveillance Program and Reactor Materials Surveillance Program)	***9***	***Various 30" to 80" long***	***0.45 ft^3***	***304 Stainless Steel***
Cylinder (casing with antimony rod)	***4***	***1-1/8"OD x 24" long***	***0.22 ft^3***	***304 Stainless Steel and antimony***

GTCC Description	Quantity	Approximate Individual Item Size	Estimated Total Volume	Material
A mixture of SNM waste, metal oxides, and stellite particles.	*1*	*12" dia x 18" high*	*<1.0 ft^3*	*Process waste within a sealed 304 Stainless Steel container*



SECTION A – A



TOP VIEW
N.T.S.

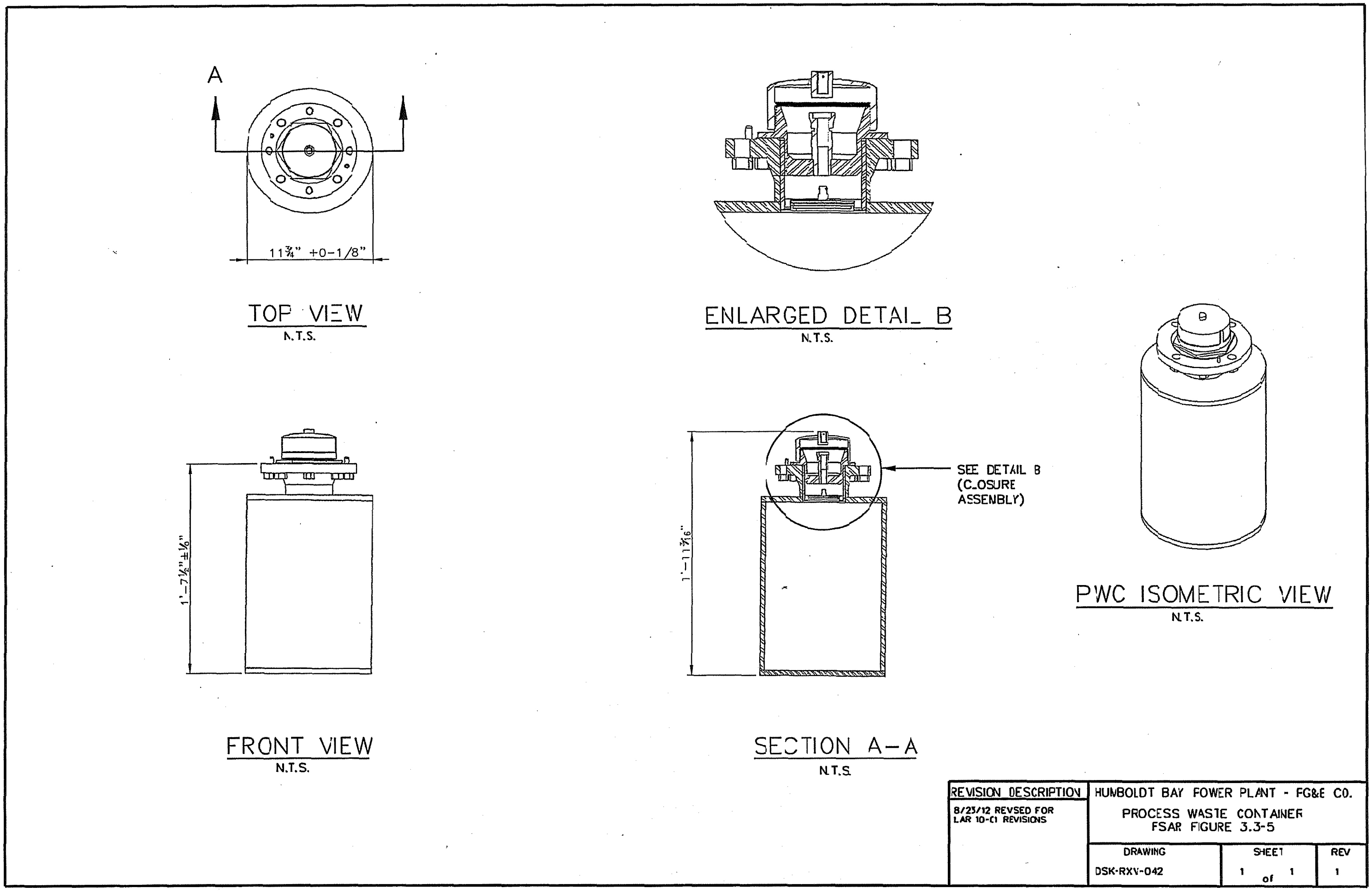
GTCC CASK ASSEMBLY
N.T.S.

NOTE:
1.) CLOSURE LIDS NOT SHOWN IN TOP VIEW FOR CLARITY.

KEY:

STEEL

REVISION DESCRIPTION	HUMBOLDT BAY SFSI GTCC CASK ASSEMBLY OVERVIEW FSAR FIGURE 3.3-4		
8/23/12 REVISED FOR LAR 10-01 REVISION 1	DRAWING	SHEET	REV
	DSK-RKV-037	1 of 1	1


A
11¾" +0-1/8"
TOP VIEW
N.T.S.
ENLARGED DETAIL B
N.T.S.
PWC ISOMETRIC VIEW
N.T.S.
1'-7½"±⅛"
FRONT VIEW
N.T.S.
SEE DETAIL B (CLOSURE ASSEMBLY)
SECTION A-A
N.T.S.
REVISION DESCRIPTION
8/23/12 REVSED FOR LAR 10-01 REVISIONS
HUMBOLDT BAY POWER PLANT - PG&E CO.
PROCESS WASTE CONTAINER
FSAR FIGURE 3.3-5
DRAWING
DSK-RXV-042
SHEET
1 of 1
REV
1

HUMBOLDT BAY ISFSI FSAR UPDATE

TABLE 4.5-1

QUALITY ASSURANCE CLASSIFICATION OF
MAJOR STRUCTURES, SYSTEMS, AND COMPONENTS

IMPORTANT TO SAFETY([a])	NOT IMPORTANT TO SAFETY
Classification Category A Multi-Purpose Canister ***GTCC Waste Container*** Fuel Basket and Basket Spacers Damaged Fuel Container HI-STAR 100 HB Overpack ***HI-STAR HB GTCC Overpack*** Transporter Lift Links **Classification Category B** ISFSI Storage Vault(c) Fuel Spacers Transporter Connector Pins Helium Fill Gas(b) Lid Retention Device ***Process Waste Container*** Cask Transporter(b) **Classification Category C**	Security Systems Fencing Lighting Electrical Power Communications Systems Automated Welding System (AWS) MPC Forced Helium Dehydration System Overpack Vacuum Drying System Rail Dolly ISFSI Storage Vault Drainage Pipe(d)

(a) Major cask system components are listed according to the highest QA category of any subcomponent comprising the major component. The safety classification of the subcomponents and the determination of the ITS category of each item is administratively controlled by PG&E via design and procurement control procedures with input from the storage cask vendor.

(b) Purchased commercial grade and qualified by testing prior to use.

(c) ISFSI storage vault lid and lid closure bolts are classified as ITS Category B except for beyond design basis soil structure interaction seismic events. For these postulated SSI seismic events, the ISFSI storage vault lid and lid closure bolts are classified as NITS since they are not relied upon in the seismic accident analysis. Refer to Section 3.2.4 and PG&E Letter HIL-05-007, dated June 3, 2005, for details of the classification.

(d) The storage vault drainage pipe is classified as NITS because the drainage system is only one of several design features relied upon to ensure adequate performance of the cask and storage vault system in the event of standing water in the vault cells. Details of the assessment performed are provided in PG&E Response to NRC Question 5-10 in PG&E Letter HIL-04-007, dated October 1, 2004.

CHAPTER 5

ISFSI OPERATIONS

This chapter describes the operations associated with the Humboldt Bay Independent Spent Fuel Storage Installation (ISFSI). Fuel movement and cask handling operations in the Humboldt Bay Power Plant (HBPP) Refueling Building (RFB) are performed in accordance with the HBPP 10 CFR 50 license. On-site cask handling outside the RFB and storage activities associated with the ISFSI are performed in accordance with the 10 CFR 72 Humboldt Bay ISFSI license. As indicated in previous chapters, the Humboldt Bay ISFSI, in its final storage configuration, is a totally passive installation. Periodic surveillance is required only to check the material condition of the casks and vault interior. No degradation of the cask or vault interior is expected.

The operations described in this chapter relate to the loading and preparation of the multi-purpose canisters (MPCs) and the overpacks and transport of the loaded overpacks from the RFB to the ISFSI storage vault. Also described is the process for off-normal event recovery, including unloading of fuel from a loaded overpack. An overview of activities occurring in the HBPP RFB is provided. Specific licensing of the components and activities is provided in the 10 CFR 50 license amendment request (LAR) associated with dry spent fuel storage.

5.1 OPERATION DESCRIPTION

The methods and sequences described below provide an overview of the operational controls that the personnel performing spent fuel loading, MPC and overpack preparation for storage, cask transfer, onsite handling, and storage activities implement to ensure safe, reliable, long-term spent fuel storage at the ISFSI storage site. Site-specific procedures are used to implement these activities, including the use of existing procedures, revision of existing procedures, and the creation of new procedures, as necessary. The specific number, wording, and sequence of site procedural steps may vary from the guidance provided here as long as the steps comply with assumptions and inputs in the governing, design-basis analyses.

Operations to load and place the HI-STAR HB System at the storage location in the ISFSI vault are performed both inside and outside the HBPP RFB. MPC fuel loading and handling operations are performed inside the RFB using existing HBPP systems and equipment for radiation monitoring, decontamination, and auxiliary support, augmented as necessary by ancillary equipment specifically designed for MPC fuel loading and handling functions. This includes the use of the davit crane and cask transfer rail dolly for heavy lifts and other cask movements. The implementing procedures incorporate applicable 10 CFR 50 license conditions and commitments, such as those governing heavy loads and fuel movements in the spent fuel pool (SFP). MPC installation in the overpack and movement of the loaded overpack to the storage location are performed using procedures developed specifically for these operations.

5.1.1 NARRATIVE DESCRIPTION

The following discussion describes the specifics of the integrated operation, including fuel loading, MPC closure operations, overpack closure operations, HI-STAR HB System handling, and placement of the loaded overpack in the ISFSI vault. To the extent practicable, the same operations as used in deploying the generic HI-STAR 100 System are used with the HI-STAR HB System. Certain operating procedures have been customized for site-specific licensing at HBPP and the Humboldt Bay ISFSI.

The MPC is loaded, while in the HI-STAR HB overpack, in the SFP. The MPC is welded and prepared for storage while in the RFB. The MPC is sealed inside the overpack in the RFB and is then transported to the ISFSI vault for storage. Section 5.1.1.1 describes loading operations for damaged fuel. Section 5.1.1.2 describes ***fuel*** cask loading and sealing operations. Section 5.1.1.3 describes the operations for transferring the loaded HI-STAR HB System to the ISFSI storage site for storage. Section 5.1.1.4 describes off-normal event recovery operations. ***Section 5.1.1.5 describes greater-than-class C (GTCC) cask loading and sealing operations, and section 5.1.1.6 describes HI-STAR HB GTCC Overpack transfer to the ISFSI storage site.***

Specific procedures identify and control the selection of fuel assemblies and greater than Class C waste (GTCC) for loading into the HI-STAR HB System or GTCC qualified casks, as appropriate. Fuel and GTCC will not be loaded in the same MPC. All HBPP fuel is acceptable for storage in the HI-STAR HB System based on a comparison of the fuel assemblies' physical characteristics against the limits specified in Section 10.2. The selected fuel assemblies are classified as intact fuel or damaged fuel in accordance with the definitions in Section 10.2, and the classification criteria described in Section 3.1.

Fuel assemblies chosen for loading are assigned a specific storage location in the MPC in accordance with the Humboldt Bay ISFSI TS and Section 10.2. The classification of the assembly (that is, intact or damaged) is used to determine the acceptable fuel storage locations for each assembly. Records are kept that track the fuel assembly, its assigned MPC, and its specific fuel storage location. Videotape (or other visual record) is used during fuel loading operations in the SFP to record fuel assembly serial numbers and to provide an independent record of the MPC inventory.

The loading, unloading, and handling operations described in this section were developed based on the Holtec International field experience in loading HI-STORM 100 and HI-STAR 100 dry cask storage systems at other ISFSIs. The equipment and operations used at these sites were evaluated and modified, as necessary, based on this experience to reduce occupational exposures and further enhance the human factors involved in performing the activities needed to successfully deploy the HI-STAR HB System at the Humboldt Bay ISFSI.

5.1.1.1 Damaged Fuel Loading

Damaged fuel containers (DFCs) are used to store damaged fuel assemblies in the MPC-HB in accordance with the requirements of the Humboldt Bay ISFSI TS and Section 10.2. Any qualified fuel assembly that is classified as damaged fuel must be stored in a DFC and be loaded into specific fuel storage locations in an MPC-HB. Two patterns for loading DFCs containing damaged fuel are permitted (see Section 10.2):

- Up to 28 DFCs around the basket periphery, or
- Up to 40 DFCs in a checkerboard pattern throughout the basket.

In both cases, the balance of fuel stored in an MPC must be intact fuel assemblies, optionally stored in DFCs themselves. Storage of damaged fuel in the HI-STAR HB System is discussed in Section 4.2.3.2.2 and the structural analysis of the containers is described in Section 4.3.2.2.10. Figure 4.2-3 shows the pertinent design details of the Humboldt Bay DFC.

5.1.1.2 *Fuel* Cask Loading and Sealing Operations

This section describes the general sequence of operations to load and seal the ***fuel*** cask, including the movement of the HI-STAR HB overpack within the RFB. Site-specific procedures control the performance of the operations, including inspection and testing. At a minimum, these procedures control the performance of activities and alert operators to changes in radiological conditions around the cask. These sequences are controlled by Humboldt Bay ISFSI TS and Section 10.2.

Several components (e.g., the davit crane and cask transfer rail dolly) are used during the cask loading process. A discussion of these items is provided for the sole purpose of describing the loading process. These items, along with their design and use, are described in the HBPP 10 CFR 50 LAR to support ISFSI operations in the RFB.

Placement of loaded HI-STAR HB overpacks in the ISFSI vault is a cyclical process involving the movement of a loaded overpack to the ISFSI and returning the empty cask transporter to the RFB for the next loading process. The operations described herein start at the time the empty MPC is loaded into the overpack and is ready for movement into the RFB.

Prior to bringing the HI-STAR HB overpack into the RFB, the overpack is visually verified to be free of foreign materials and the top lid sealing surface is visually inspected for potential damage. Also, an empty MPC has been cleaned, inspected, and inserted into the overpack. Alignment marks are checked to ensure correct rotational alignment between the MPC and the HI-STAR HB overpack.

The HI-STAR HB overpack containing an empty MPC is brought into the RFB in the vertical orientation through the railroad door on the cask transfer rail dolly that runs from inside the RFB to the Unit 3 yard. The cask transfer rail dolly is used because dimensional limitations of the RFB door prevent access of the cask transporter inside the RFB. After bringing the overpack into the RFB, the overpack is positioned under the davit crane that is configured with the lift yoke and the overpack annulus overpressure system is connected.

The overpack-to-MPC annulus is filled with clean water and the inflatable annulus seal is installed in the top part of the annulus to minimize the risk of contaminating the external shell of the MPC. The MPC internal cavity is filled with SFP water or water from another suitable source to prevent splash-back when the cask is lowered into the SFP. The lift yoke engages the overpack lifting trunnions and is used to raise and lower the overpack during loading operations inside the RFB.

The HI-STAR HB overpack is raised by the davit crane, positioned over the cask loading area of the SFP, and lowered using the davit crane hoist until the top the overpack is nearly level with the water level in the annulus overpressure system. The annulus overpressure system supply line to the overpack is opened and the overpack is lowered to the bottom of the SFP. The annulus overpressure system applies a slight overpressure to the annulus to protect the MPC external shell from contamination from the SFP water in the event there is a leak in the annulus seal. When the cask is fully lowered to the bottom of the cask loading area in the SFP, the lift yoke is remotely disconnected from the overpack and moved out of the way to allow fuel loading into the cask.

Fuel-loading and post-loading verification of correct fuel assembly placement in the MPC (i.e., assembly identification and storage cell location) is conducted in accordance with approved fuel-handling procedures. For damaged fuel assemblies, the assembly is loaded into the DFC, and the DFC is loaded into the MPC. Optionally, an empty DFC may be first loaded into the appropriate fuel storage location in the MPC and then the damaged fuel assembly may be loaded into the DFC. Intact fuel assemblies may be stored in DFCs at Pacific Gas and Electric's (PG&E) discretion.

The MPC lid, with the drain line attached, is placed in position in the MPC after the completion of fuel loading and verification, while the HI-STAR HB overpack is in the SFP. The lift devices are detached from the MPC lid allowing the lift yoke, which is attached to the davit crane, to be lowered to the overpack to engage the lifting trunnions. The overpack and lift yoke are raised until the top of the MPC and overpack break the water surface. The annulus overpressure supply line is closed and the overpressure system is disconnected. Initial decontamination of the overpack may be performed as the overpack emerges from the SFP or in any other manner approved by the Radiation Protection (RP) Department. The overpack is raised completely out of the SFP. The overpack is placed onto the cask transfer rail dolly in the cask washdown area. The lid retention device is attached. The lift yoke is disconnected and removed from the area.

The MPC water volume is reduced to provide enough space between the water surface and the lid to avoid a water-weld interaction. The inflatable annulus seal is removed and the annulus water level is lowered. Once the top edge of MPC shell is surveyed and found to be in satisfactory condition, the annulus shield is installed. The lid retention device remains in place until a sufficient number of tack welds are applied, and is then removed to allow room for the automatic weld system to be installed.

The space under the MPC lid is exhausted or purged during welding operations to prevent combustible gas concentrations that may result from the oxidation of the neutron absorber panels in the water. Appropriate monitoring for combustible gas concentrations is performed prior to and during MPC lid welding operations. The MPC lid-to-shell weld, including liquid penetrant inspections after the root pass, each approximately 3/8-inch of weld depth, and after the final pass, is then completed.

Once the lid-to-shell weld is complete, the MPC undergoes a pressure test for leaks in accordance with the ASME Code. The lid-to-shell weld is liquid penetrant inspected after the pressure test. Either prior to, or following successful completion of the pressure test (depending on whether a hydrotest or pneumatic test is performed), the Removable Valve Operating Assemblies (RVOAs) are installed and the remaining MPC water is displaced from the MPC by pumping or blowing pressurized nitrogen or helium gas into the MPC. The water may be drained from the overpack annulus and vacuum drying or the Forced Helium Dehydration (FHD) System is used to remove the remaining liquid water from the MPC and to ultimately reduce the moisture content of the MPC cavity to an acceptable level.

Following the successful completion of moisture removal from the MPC, the MPC is backfilled with helium to within the required pressure range. Helium backfill to the required pressure range ensures that the conditions for heat transfer inside the MPC are consistent with the thermal analyses and provides an inert atmosphere to ensure long-term fuel integrity. After successful helium backfill operations, the RVOAs are removed and the MPC vent and drain port cover plates are installed, welded, and examined. The MPC closure ring is then installed, welded, and examined.

The HI-STAR HB overpack and accessible portions of the MPC are checked to ensure any removable contamination is within applicable limits. Additional decontamination and surveys may be performed throughout the loading process. The closure plate is installed on the HI-STAR HB with the redundant mechanical seals, and the bolts are tightened to seat the seals. The overpack annulus is drained, if not previously completed, and dried using the vacuum drying system and the annulus is backfilled with helium in accordance with the Humboldt Bay ISFSI TS and Section 10.2.

The integrity of the closure plate mechanical seals is verified by performing a helium leakage test between the seals using the overpack test port. Upon successful completion of the seal leakage test, a test port plug and cover plate are installed. The overpack vent and drain ports are then sealed with port plugs and the port plugs are helium leakage tested. Upon successful testing of the port plugs, the vent and drain port covers are installed and the cask is ready for transport to the ISFSI storage vault.

The loaded overpack is moved out of the RFB along the rail dolly using a winch system or similar device and positioned under the lift beam of the cask transporter with the lift links attached.

5.1.1.3 *Fuel Cask* Transfer to the ISFSI Storage Site

The cask transporter is positioned outside the RFB doors to receive the HI-STAR HB overpack from the cask transport rail dolly. The transporter will have undergone preoperational testing and maintenance and is operated in accordance with the Cask Transportation Evaluation Program, which evaluates and controls the transportation of loaded overpacks between the HBPP RFB and ISFSI vault. The cask transporter lift links engage the HI-STAR HB lifting trunnions and the overpack is lifted off of the rail dolly. A restraining strap is used to secure the overpack to the transporter. The overpack is transported to the ISFSI vault along the approved transportation route using appropriate administrative controls as described in Section 4.3.3 and shown in Figure 2.2-2.

The cask transporter centers the HI-STAR HB overpack over the open vault storage cell. The restraining strap is released from the overpack. The cask transporter towers are used to lower the overpack down into the vault and the lift links are removed. The cask transporter is driven away from the ISFSI vault, the seismic shims are installed, and the storage cell lid is installed.

5.1.1.4 Off-Normal Event Recovery Operations

The evaluations of off-normal and accident events, as defined in ANSI/ANS-57.9 (Reference 1) and as applicable to the Humboldt Bay ISFSI, are presented in Chapter 8. Each postulated off-normal and accident event evaluated and discussed in Chapter 8 addresses the event cause, analysis, and consequences. Suggested corrective actions are also provided for off-normal events. The actual cause, consequences, corrective actions, and actions to prevent recurrence (if required) will be determined through the HBPP corrective action program on a case-specific basis. All corrective actions will be taken in a timely manner, commensurate with the safety significance of the event. Of primary importance in the early response to any event will be the verification of continued criticality prevention, the protection of fuel cladding integrity (that is, heat removal), and the adequacy of radiation shielding while longer-term corrective actions are developed. This may also involve the need for temporary shielding or cask cooling in accordance with the recommendations of PG&E technical staff personnel, based on the event conditions.

Should the need arise during the loading campaign, the MPC can be returned to the SFP for unloading. To unload a HI-STAR HB overpack, the operations described above are effectively executed in reverse order from the point in the operation at which the event occurred. Once the overpack is back in the RFB, the overpack closure plate is removed, and preparations are made to re-open the MPC in the SFP. This involves first installing the annulus shield and cutting or grinding out the welds to remove the MPC closure ring and vent and drain port cover plates.

Then, the bulk temperature of the gas in the MPC cavity is ensured to be below the maximum value to allow re-flooding. Given the age of the fuel at the time of loading, it is unlikely that the cavity gas will require cooling prior to re-flooding. Nevertheless, the bulk gas temperature will be determined and cooled using appropriate means, if necessary. Appropriate means could include recirculating water in the overpack annulus and/or helium recirculation with the FHD system to cool the MPC to a temperature at or below the maximum allowed temperature for re-flooding in accordance with the Humboldt Bay ISFSI TS and Section 10.2.

Ensuring the MPC cavity bulk gas temperature to be below the maximum allowed temperature allows the MPC to be re-flooded with water with a minimal amount of flashing and the associated undesirable pressure spikes in the MPC cavity. The weld removal system is used to cut the MPC lid weld. Once the lid weld is removed, the lid retention device is installed.

After re-flooding, appropriate monitoring for combustible gas concentrations shall be performed prior to, and during, MPC lid cutting operations to prevent the build-up of combustible mixtures caused by oxidation of neutron absorber panels contained in the MPC. In addition, the space below the MPC lid shall be exhausted prior to, and during, MPC lid welding operations to provide additional assurance that explosive gas mixtures will not develop in this space.

When the lid weld has been successfully cut, the annulus shield is removed. The annulus is filled with clean water and the annulus overpressure system and annulus seal are installed. The lift yoke is installed on the davit crane and attached to the overpack. The davit crane moves the overpack and MPC over the cask loading area of the SFP and lowers it to the SFP floor. As the top of the HI-STAR HB reaches a level approximately equal to the SFP level, the supply line from the annulus overpressure system is connected and opened. Once in the SFP, the lid retention device and the MPC lid are removed and the spent fuel assemblies are removed from the MPC and placed back into the wet storage racks as necessary.

5.1.1.5 GTCC Cask Loading and Sealing Operations

This section describes the general sequence of operations to load and seal the GTCC cask, including the movement of the HI-STAR HB GTCC Overpack within the RFB. Site-specific procedures control the performance of the operations, including inspection and testing. At a minimum, these procedures control the performance of activities and alert operators to changes in radiological conditions around the cask. These sequences are controlled by Humboldt Bay ISFSI TS and Section 10.2.

Several components (e.g., the RFB crane and cask transfer rail dolly) are used during the cask loading process. A discussion of these items is provided for the sole purpose of describing the loading process.

Prior to bringing the HI-STAR HB GTCC Overpack into the RFB, the overpack is visually verified to be free of foreign materials or physical damage. Also, the empty GTCC Waste Container (GWC) has been cleaned, inspected, and inserted into the overpack. Alignment marks are checked to ensure correct rotational alignment between the GWC and the overpack. The GWC is similar to the Multi-Purpose Canister (MPC) within a spent fuel cask and has an outer container welded to the bottom of the GWC. The GWC is shown in Figure 3.3-4.

The overpack containing an empty GWC is brought into the RFB in the vertical orientation through the railroad door on the cask transfer rail dolly that runs from inside the RFB to the Unit 3 yard. The cask transfer rail dolly is used because dimensional limitations of the RFB door prevent access of the cask transporter inside the RFB. After bringing the overpack into the RFB, the overpack is positioned under the RFB crane that is configured with the lift yoke and the overpack annulus overpressure system is connected.

The overpack-to-GWC annulus is filled with clean water and the inflatable annulus seal is installed in the top part of the annulus to minimize the risk of contaminating the external shell of the GWC. The GWC internal cavity is filled with SFP water or water from another suitable source to prevent splash-back when the cask is lowered into the SFP. The lift yoke engages the overpack lifting trunnions and is used to raise and lower the overpack during loading operations inside the RFB.

The overpack is raised by the RFB crane, positioned over the cask loading area of the SFP, and lowered using the RFB crane hoist until the top of the overpack is nearly level with the water level in the annulus overpressure system. The annulus overpressure system supply line to the overpack is opened and the overpack is lowered to the bottom of the SFP. The annulus overpressure system applies a slight overpressure to the annulus to protect the GWC external shell from contamination from the SFP water in the event there is a leak in the annulus seal. When the cask is fully lowered to the bottom of the cask loading area in the SFP, the lift yoke is remotely disconnected from the overpack and moved out of the way to allow loading GTCC waste into the cask.

Loading GTCC waste (including the process waste container and the irradiated hardware pieces) is conducted in accordance with approved procedures. The GTCC process waste contained in the PWC will be thermally processed offsite at a vendor's facility. A dry heating process known as dry-ashing will be used to remove organics and other hydrogen bearing components from the process waste to produce a dry concentrated residue. The residue will have sufficiently *low hydrogen content to mitigate the formation of hydrogen gas from radiolytic decomposition in long term storage casks. This is needed to maintain hydrogen at less than 5 percent by volume of the PWC void space [USNRC Information Notice 84-72, Clarification of Conditions for Waste Shipments Subject to Hydrogen Gas Generation]. After the dry-ashing process is complete, the vendor will vacuum dry the PWC, install a mechanical seal and backfill the PWC with helium and conduct a leak test. The PWC will be returned to HBPP and stored in the spent fuel pool (SFP), a wet environment; however, the process waste contained in the PWC will remain dry. The PWC will eventually be loaded into the GWC in the SFP.*

After the PWC has been loaded into the GWC, the activated metals will be loaded into the GWC. The GWC will be moved out of the SFP, drained, vacuum dried and backfilled with helium.

The GWC lid, with the drain line attached, is placed in position in the GWC after the completion of loading GTCC waste, while the overpack is in the SFP. The lift devices are detached from the GWC lid allowing the lift yoke, which is attached to the RFB crane, to be lowered to the overpack to engage the lifting trunnions. The overpack and lift yoke are raised until the top of the GWC and overpack break the water surface. The annulus overpressure supply line is closed and the overpressure system is disconnected. Initial decontamination of the overpack may be performed as the overpack emerges from the SFP or in any other manner approved by the Radiation Protection (RP) Department.

The overpack is raised completely out of the SFP. The overpack is placed onto the cask transfer rail dolly in the railroad bay. The lift yoke is disconnected and moved from the area.

The GWC water volume is reduced to provide enough space between the water surface and the lid to avoid a water-weld interaction. The inflatable annulus seal is removed and the annulus water level is lowered. Once the top edge of GWC shell is surveyed and found to be in satisfactory condition, the annulus shield is installed if required by Radiation Protection personnel for dose considerations.

Although no combustible gas is expected, the space under the GWC lid is exhausted or purged during welding operations to prevent combustible gas concentrations from accumulating. Appropriate monitoring for combustible gas concentration is performed prior to and during GWC lid welding operations. The GWC lid-to-shell weld is then completed, including liquid penetrant inspections after the root pass, each approximately 3/8-inch of weld depth, and after the final pass.

Once the lid-to-shell weld is complete, the GWC undergoes a pressure test for leaks in accordance with the ASME Code. The lid-to-shell weld is liquid penetrant inspected after the pressure test. Either prior to, or following successful *completion of the pressure test (depending on whether a hydrotest or pneumatic test is performed), the Removable Valve Operating Assemblies (RVOAs) are installed and the remaining GWC water is displaced from the GWC by pumping or blowing pressurized nitrogen or helium gas into the GWC. The water may be drained from the overpack annulus and vacuum drying is used to remove the remaining liquid water from the GWC and to ultimately reduce the moisture content of the MPC cavity to an acceptable level.*

Following the successful completion of moisture removal from the GWC, the GWC is backfilled with helium to a nominal pressure range of 10 to 15 psig. Helium backfill provides an inert atmosphere to ensure long-term waste integrity. After successful helium backfill operations, the RVOAs are removed and the GWC vent and drain port cover plates are installed, welded, and examined. The GWC closure ring is then installed, welded, and examined.

The overpack and accessible portions of the GWC are checked to ensure any removable contamination is within applicable limits. Additional decontamination and surveys may be performed throughout the loading process. The closure plate is installed on the overpack and the bolts are tightened as specified by the cask manufacturer.

The overpack annulus is drained, if not previously completed, and the cask is ready for transfer to the ISFSI storage vault. The loaded overpack is moved out of the RFB using the cask transport rail dolly and positioned under the lift beam of the cask transporter with the lift links attached.

5.1.1.6 GTCC Cask Transfer to the ISFSI Storage Site

The cask transporter is positioned outside the RFB doors to receive the HI-STAR HB GTCC overpack from the cask transport rail dolly. The cask transporter lift links engage the HI-STAR HB lifting trunnions and the overpack is lifted off of the rail dolly. A restraining strap is used to secure the overpack to the transporter. The overpack is transported to the ISFSI vault along the approved transportation route using appropriate administrative controls as described in Section 4.3.3 and shown in Figure 2.2-2.

The cask transporter centers the HI-STAR HB GTCC overpack over the open vault storage cell. The restraining strap is released from the overpack. The cask transporter towers are used to lower the overpack down into the vault and the lift links are removed. The cask transporter is driven away from the ISFSI vault, the seismic shims are installed, and the storage cell lid is installed.

5.1.2 IDENTIFICATION OF SUBJECTS FOR SAFETY AND RELIABILITY ANALYSIS

5.1.2.1 Criticality Prevention

A summary description of the principal design features, procedures, and special techniques used to preclude criticality in the design and operation of the HI-STAR HB System is provided in Section 3.3.1.4. Additional detail on the criticality design of the storage cask is provided in Section 4.2.3.3.7.

5.1.2.2 Instrumentation

Examples of measuring and test equipment (M&TE) used during the preparation of the cask for storage operations are listed in Table 5.1-1. Additional, or different M&TE, may be used as determined through the development of site-specific operating procedures, including the revision of those procedures as experience in cask loading operations is gained and the state of the art evolves.

No instrumentation is required to detect off-normal operations of the HI-STAR HB System while in its final storage configuration at the ISFSI storage site. The cask system is designed to maintain confinement integrity under all design-basis normal, off-normal, and accident conditions.

5.1.2.3 Maintenance Techniques

No periodic maintenance is required to ensure the safe, long term operation of the Humboldt Bay ISFSI. Any required corrective maintenance will be completed under the work control process.

5.1.3 REFERENCES

1. ANSI/ANS-57.9-1992, Design Criteria for an Independent Spent Fuel Storage Installation (dry type), American National Standards Institute.

PROPOSED CHANGES TO FSAR SECTIONS 3.1, 4.5 AND 5.1 (FINAL)

3.1 PURPOSES OF INSTALLATION

The Humboldt Bay Independent Spent Fuel Storage Installation (ISFSI) is designed for interim, dry, and below ground vault storage of intact and damaged spent nuclear fuel assemblies, and reactor-related greater than class C (GTCC) waste from Humboldt Bay Power Plant (HBPP) Unit 3. The ISFSI uses the Holtec International HI-STAR HB storage system, as discussed in Section 1.1.

The material from the HBPP spent fuel pool is sealed in multi-purpose canisters custom-designed for HBPP fuel (MPC-HBs), and the MPCs are stored in HI-STAR HB storage/transportation overpacks in a reinforced concrete vault. The ISFSI is designed to store up to 400 spent fuel assemblies in five casks, with a sixth cask to store GTCC waste.

Each MPC-HB can store up to 80 spent nuclear fuel assemblies. Each MPC-HB is also capable of storing 80 damaged fuel containers (DFCs), of which 28 or 40, depending on the loading pattern, can contain damaged fuel as needed to store the entire HBPP spent fuel inventory at the ISFSI.

3.1.1 MATERIAL TO BE STORED

The materials to be stored at the ISFSI consist of intact fuel assemblies, damaged fuel assemblies, and GTCC waste. The fuel assemblies may be stored with, or without channels. There are 390 fuel assemblies in the HBPP inventory, and a quantity of loose debris that could constitute an equivalent of one additional assembly. Each fuel assembly contains approximately 192 pounds (87 kg) of UO_2. Damaged fuel is stored in a damaged fuel container (DFC) in an MPC-HB in accordance with ISG-1, Revision 1 (Reference 1). Damaged fuel in the form of loose fuel rods, fuel pellets, etc. can be consolidated; however, The amount of fuel debris in a single DFC is limited to the total fissile material and weight of a single intact fuel assembly. The loose debris may be stored in one or two DFCs to optimize the retrieval and handling operations.

Video inspection of the Humboldt Bay spent fuel assemblies was conducted in 2000-2001 using the guidance of ISG-1 Revision 0, Nuclear Energy Institute comments on ISG-1, and the definitions of damaged fuel and fuel debris contained in the Holtec HI-STAR 100 Certificate of Compliance (CoC). Eleven fuel assemblies were initially classified as damaged and 16 were classified as fuel debris. A supplemental evaluation of the 2000-2001 video records will be performed prior to fuel loading using the guidelines in Table 3.1-1, which meets the intent of ISG-1 Revision 1.

Discussed herein are the characteristics of these materials and how the HI-STAR HB storage system design criteria envelopes these characteristics.

3.1.1.1 Physical Characteristics

The spent fuel assemblies to be stored consist of General Electric Type II (a 7 x 7 array of fuel rods), General Electric Type III, Exxon Type III, and Exxon Type IV (a 6 x 6 array of fuel rods) fuel assemblies. Construction details for each type are similar (References 2 through 5). The main support structure for an assembly consists of fuel rods used as tie rods between upper and lower tie plates. All assemblies use three spacer grids attached to a single spacer capture rod to maintain fuel rod spacing. The licensing basis fuel cladding material for all assemblies is any zirconium-based alloy, consistent with the HI-STAR 100 System CoC. Fuel records indicate that all HBPP fuel cladding material for intact and damaged assemblies is Zircaloy-2. Channels are fabricated from Zircaloy material. The loose fuel debris described in Section 3.1.1 may have either Zircaloy cladding, stainless steel cladding, or may be unclad pellets. A summary of the physical characteristics of the Humboldt Bay fuel proposed for storage at the ISFSI is shown in Table 3.1-2.

Fuel records have been maintained to identify the configuration and initial enrichment of each fuel assembly. Each fuel assembly is identified with a unique identification number. Each assembly will be recorded as to its cask loading location.

3.1.1.2 Thermal and Radiological Characteristics

The thermal and radiological characteristics of the HBPP fuel to be stored are summarized below, and constitute limiting values for storage of fuel assemblies at the Humboldt Bay ISFSI. The values listed below were used in the analyses supporting the design and bound the actual values for these parameters for the entire HBPP spent fuel inventory to provide margin. All loose fuel debris is bounded by these parameters.

(1) Heat Generation

The maximum permitted heat generation rate for a single assembly that is stored at the Humboldt Bay ISFSI is 50 watts. The maximum total heat load for a single cask is 2000 watts.

(2) Fuel Burnup

The maximum average fuel burnup per assembly of any fuel that is stored at the ISFSI is 23,000 MWD/MTU.

(3) Cooling Time

The minimum cooling time of any fuel that is stored at the ISFSI is 29 years at the time of the first fuel loading in the ISFSI.

(4) Enrichment

The maximum planar-average enrichment for any one fuel assembly is 2.60 wt. % ^{235}U.

The minimum planar-average enrichment for any one fuel assembly is 2.08 wt. % ^{235}U.

(5) External Condition

The fuel cladding surface is fairly uniformly coated with a crud layer, which appears to be primarily oxide from the carbon steel piping system. The actual thickness of the oxide has not been determined. However, NUREG 0649 states that typically, the oxide buildup on BWR pins is on the order of 25 to 100 microns and in the form of FE_2O_3. The NUREG further states that a calculation was made to determine whether a 100 micron buildup would affect heatup of the pins during a pool drainage accident, and found that the overall effect on pin temperature was less that one degree. There are several assemblies that have additional loose crud material attached.

3.1.1.3 Non-fuel Hardware and Neutron Sources

No non-fuel hardware or neutron sources are to be stored at the Humboldt Bay ISFSI.

3.1.1.4 Greater Than Class C Waste

Table 3.1-3 lists neutron activated components and process waste materials at HBPP that may potentially be classified as GTCC and stored at the ISFSI. The activated metals have been placed on this list due to close proximity to the reactor core (e.g., within approximately 12 inches of active fuel) and exposure to a peak core thermal neutron flux of slightly greater than 1×10^{13} neutrons/sec/cm^2 during 13 years of reactor operation. The actual quantity of activated metals may be less than that listed, due to the conservatism used in this assumption. An accurate classification of this waste material will be performed prior to loading into the GTCC Waste Container (GWC).

The process waste material was generated during cleanup of the spent fuel pool. The material consists of distributed and particulate SNM waste mixed with resins, metallic oxides, and small Stellite particles. The total activity is 4.85E+4 mCi, of which there are 18.3 grams of SNM waste. After thermal processing, the process waste material will be in the form of a dry concentrated residue.

As shown on Figure 3.3-4, the GWC is contained within the HI-STAR HB GTCC Overpack. The GWC is similar to the Multi-Purpose Canister (MPC) within a spent fuel cask. Also shown is the Outer Container that is welded onto the bottom of the GWC. The process waste will be contained in a Process Waste Container (PWC), shown on

Figure 3.3-5. The PWC is a stainless steel, cylindrical container, approximately 12 inches in diameter and 24 inches high and will be mechanically sealed, vacuum dried, backfilled with helium and leak tested. The PWC will be placed within the Outer Container inside the GWC. The Outer Container is designed to provide stabilization for the PWC. A lid will be placed on top of the Outer Container. The activated metals will be placed inside the GWC and outside of the Outer Container. Therefore, the process waste is prevented from co-mingling with the GTCC activated metals.

After loading the GTCC waste into the GWC, a lid will be placed on top of the GWC and will be welded to the shell. The GWC will be vacuum dried, backfilled with helium and leak tested. Then a lid will be placed on top of the HI-STAR HB GTCC Overpack and bolted shut.

The radiation dose at the surface of the HI-STAR HB GTCC Overpack is bounded by that assumed in the analysis performed for a HI-STAR HB spent fuel overpack. GTCC is stored in a separate cask from spent fuel in accordance with 10 CFR 72.120(b)(1). There are no criticality or decay heat issues associated with the storage of GTCC waste.

3.1.2 REFERENCES

1. Interim Staff Guidance 1, Damaged Fuel, USNRC, Revision 0, May 1999 and Revision 1, October 2002.

2. General Electric Drawing GE 731E272 (GE Type II Fuel Assembly), PG&E Drawing #6019924, Sheet 13.

3. General Electric Drawing GE 731E228 (GE Type III Fuel Assembly), PG&E Drawing #6019924, Sheet 14.

4. Exxon Nuclear (Jersey Nuclear) Drawing Nuclear R-1330 (Exxon Type III Fuel Assembly), PG&E Drawing #6019924, Sheet 15.

5. Exxon Nuclear Drawing XN 300.900 (Exxon Type IV Fuel Assembly), PG&E Drawing #6019924, Sheet 16

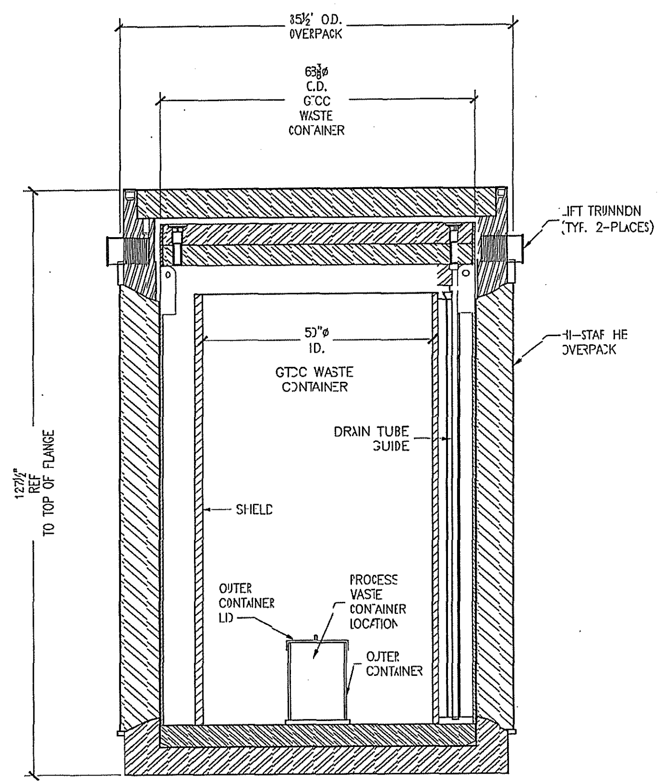
HUMBOLDT BAY ISFSI FSAR UPDATE TABLE 3.1-3

POTENTIAL GREATER THAN CLASS C WASTE

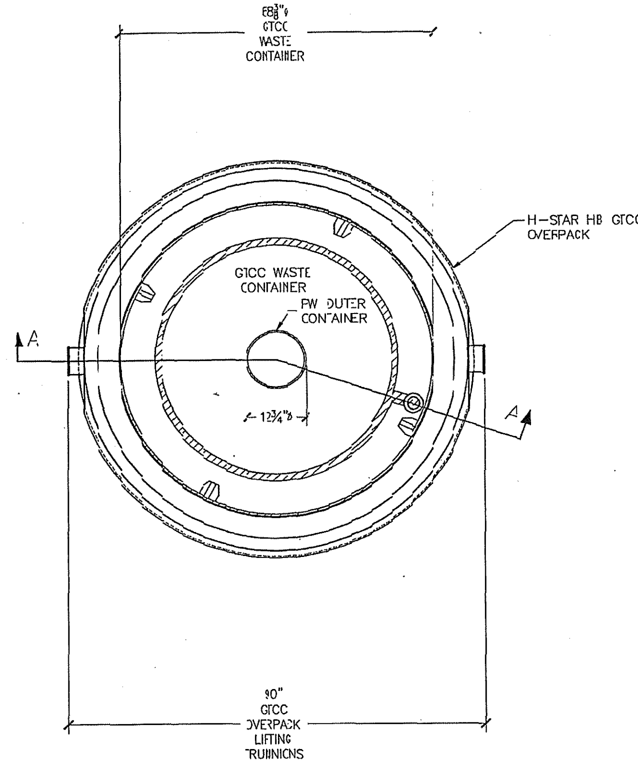
GTCC Description	Quantity	Approximate Individual Item Size	Estimated Total Volume	Material
Rollers punched from control rod blades and control rod followers	400	Cylindrical 1" dia x 1/2" h	0.09 ft^3	Stellite
Miscellaneous loose hardware from fuel assemblies - cap screws, lock washers, spring clips, spacers and compression springs	Unknown	Small	<0.10 ft^3	304 Stainless Steel, Inconel-X
Incore Thermocouple Tube	1	¾" ODx16ft long	<0.03 ft^3	304 Stainless Steel
Internal removable core support plates (4 fuel assemblies each)	32	10.375" x 10.466" x 1"	2.0 ft^3	ASTM A351-58T, Grade CF-8 304 Stainless Steel
Fuel support plate - 12 holes	4	Irregular (Semi-circular) (48" largest dimension)	1 ft^3	ASTM A351-58T, Grade CF-8 304 Stainless Steel
Fuel support plate - 3 holes	4	Irregular (Semi-circular) (16" largest dimension)	0.35 ft^3	ASTM A351-58T, Grade CF-8 304 Stainless Steel
Flux monitor socket	8	2-3/4" x 4-1/2" x 6"	0.35 ft^3	304 Stainless Steel
Socket –Lower Core Support, intersection of beams and rods	37	Cylindrical 1-3/4" dia x 2-1/2" h	0.13 ft^3	304 Stainless Steel

GTCC Description	Quantity	Approximate Individual Item Size	Estimated Total Volume	Material
Beam - Core Support	2	3/8" x 4-1/2" x 58"	0.12 ft^3	304 Stainless Steel
Beam - Core Support	4	3/8" x 4-1/2" x 37"	0.15 ft^3	304 Stainless Steel
Beam - Core Support	2	3/8" x 4-1/2" x 31"	0.06 ft^3	304 Stainless Steel
Beam - Core Support	4	3/8" x 4-1/2" x 20"	0.08 ft^3	304 Stainless Steel
Beam - Core Support	2	3/8" x 4-1/2" x 40"	0.08 ft^3	304 Stainless Steel
Beam - Core Support	1	3/8" x 4-1/2" x 19"	0.02 ft^3	304 Stainless Steel
Rod - Core Support	4	3/8" O.D. x 45"	0.012 ft^3	304 Stainless Steel
Rod - Core Support	2	3/8" O.D. x 40"	0.006 ft^3	304 Stainless Steel
Rod - Core Support	4	3/8" O.D. x 41"	0.011 ft^3	304 Stainless Steel
Rod - Core Support	4	3/8" O.D. x 32"	0.009 ft^3	304 Stainless Steel
Rod - Core Support)	8	3/8" O.D. x 22"	0.012 ft^3	304 Stainless Steel
Rod - Core Support)	4	3/8" O.D. x 19"	0.005 ft^3	304 Stainless Steel
Rod - Core Support	4	3/8" O.D. x 11"	0.003 ft^3	304 Stainless Steel
Miscellaneous hardware for core support assembly (u-bolts, bolts, screws, nuts, dowel pins, groove pins and safety wire)	Various	small	< 0.1 ft^3	304 Stainless Steel

GTCC Description	Quantity	Approximate Individual Item Size	Estimated Total Volume	Material
Rim of Upper Shroud	1	86" O.D. x 82-1/2" I.D.	1.0 ft^3	304 Stainless Steel
Cylinder (part of upper core shroud - surrounds the reactor core) - includes miscellaneous associated hardware (blocks, locating pins, gussets, etc.)	1	96" O.D. x 95-3/8" h x 1/4" thick	4.5 ft^3	304 Stainless Steel
Chimney clamps and support brackets (includes all associated hardware and components)	8	Irregular 6"x12"x8"	0.93 ft^3	304 Stainless Steel, Inconel-X
Lower portion of fuel hold down at the top of the core	45	Pipe: 1-1/2" O.D. x 3 ft. Latch: 1/2" x 1-1/2" x 4-1/4"	1.8 ft^3	304 Stainless Steel
Portions of Lower Core support ring	Various	Cut to fit	2.9 ft^3	304 Stainless Steel
Upper Core Guide (Chimney base plate and grid former)	Various	Cut to fit	2.1 ft^3	304 Stainless Steel
Specimen baskets, specimens and associated hardware (RPV Shell Surveillance Program and Reactor Materials Surveillance Program)	9	Various 30" to 80" long	0.45 ft^3	304 Stainless Steel
Cylinder (casing with antimony rod)	4	1-1/8"OD x 24" long	0.22 ft^3	304 Stainless Steel and antimony
A mixture of SNM waste, metal oxides, and stellite particles.	1	12" dia x 18" high	<1.0 ft^3	Process waste within a sealed 304 Stainless Steel container



SECTION A – A



TOP VIEW
N.T.S.

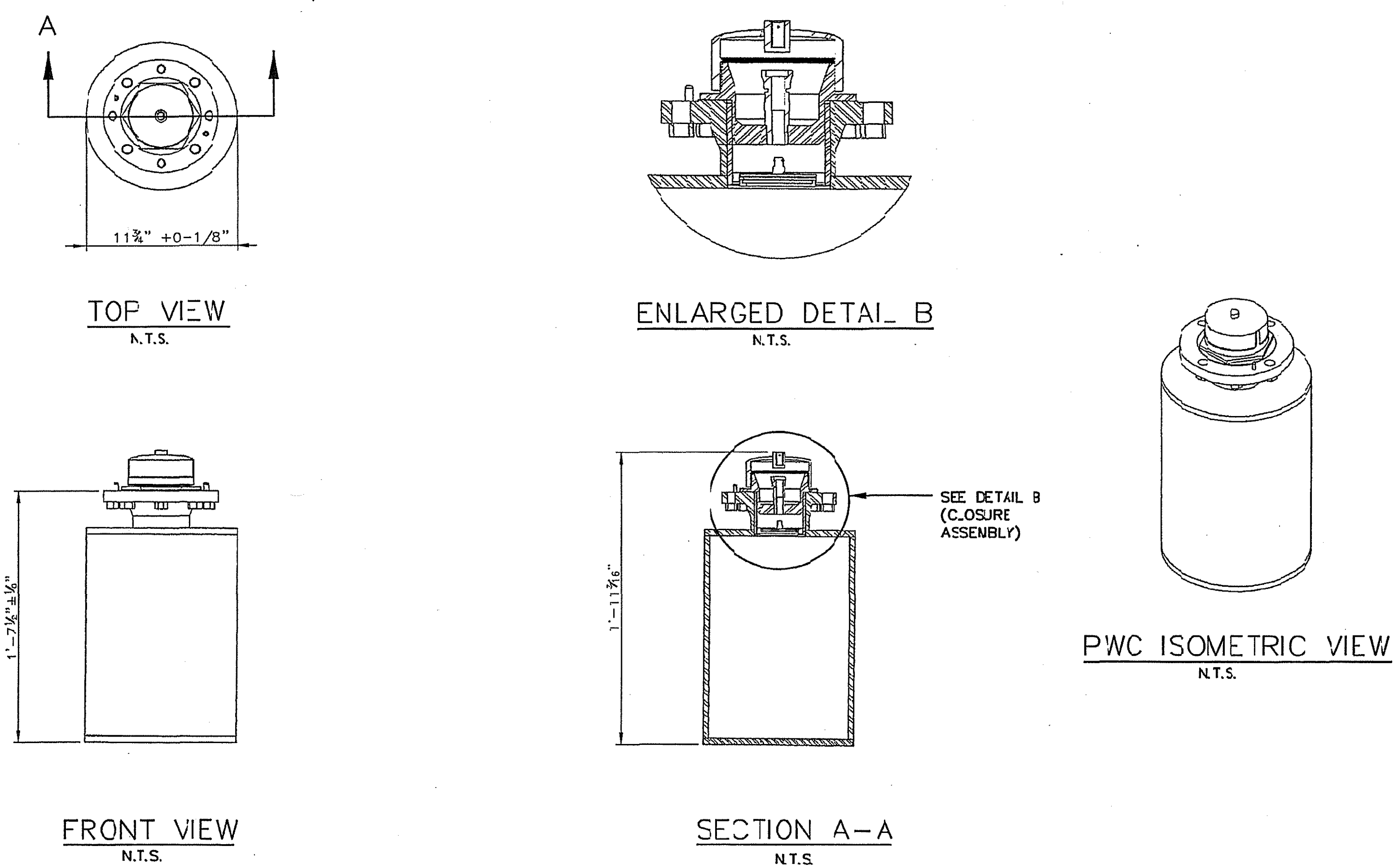
GTCC CASK ASSEMBLY
N.T.S.

NOTE:
1.) CLOSURE LIDS NOT SHOWN IN TOP VIEW FOR CLARITY.

KEY:

STEEL

REVISION DESCRIPTION	HUMBOLDT BAY ISFSI GTCC CASK ASSEMBLY OVERVIEW FSAR FIGURE 3.3-4		
8/23/12 REVISED FOR LAR 10-01 REVISION 1	DRAWING	SHEET	REV
	DSK-RKV-037	1 of 1	1



REVISION DESCRIPTION	HUMBOLDT BAY POWER PLANT - PG&E CO.		
8/23/12 REVISED FOR LAR 10-01 REVISIONS	PROCESS WASTE CONTAINER FSAR FIGURE 3.3-5		
	DRAWING	SHEET	REV
	DSK-RXV-042	1 of 1	1

HUMBOLDT BAY ISFSI FSAR UPDATE

TABLE 4.5-1

QUALITY ASSURANCE CLASSIFICATION OF
MAJOR STRUCTURES, SYSTEMS, AND COMPONENTS

IMPORTANT TO SAFETY(a)	NOT IMPORTANT TO SAFETY
Classification Category A Multi-Purpose Canister GTCC Waste Container Fuel Basket and Basket Spacers Damaged Fuel Container HI-STAR 100 HB Overpack HI-STAR HB GTCC Overpack Transporter Lift Links **Classification Category B** ISFSI Storage Vault(c) Fuel Spacers Transporter Connector Pins Helium Fill Gas(b) Lid Retention Device Process Waste Container Cask Transporter(b) **Classification Category C**	Security Systems Fencing Lighting Electrical Power Communications Systems Automated Welding System (AWS) MPC Forced Helium Dehydration System Overpack Vacuum Drying System Rail Dolly ISFSI Storage Vault Drainage Pipe(d)

(a) Major cask system components are listed according to the highest QA category of any subcomponent comprising the major component. The safety classification of the subcomponents and the determination of the ITS category of each item is administratively controlled by PG&E via design and procurement control procedures with input from the storage cask vendor.

(b) Purchased commercial grade and qualified by testing prior to use.

(c) ISFSI storage vault lid and lid closure bolts are classified as ITS Category B except for beyond design basis soil structure interaction seismic events. For these postulated SSI seismic events, the ISFSI storage vault lid and lid closure bolts are classified as NITS since they are not relied upon in the seismic accident analysis. Refer to Section 3.2.4 and PG&E Letter HIL-05-007, dated June 3, 2005, for details of the classification.

(d) The storage vault drainage pipe is classified as NITS because the drainage system is only one of several design features relied upon to ensure adequate performance of the cask and storage vault system in the event of standing water in the vault cells. Details of the assessment performed are provided in PG&E Response to NRC Question 5-10 in PG&E Letter HIL-04-007, dated October 1, 2004.

CHAPTER 5

ISFSI OPERATIONS

This chapter describes the operations associated with the Humboldt Bay Independent Spent Fuel Storage Installation (ISFSI). Fuel movement and cask handling operations in the Humboldt Bay Power Plant (HBPP) Refueling Building (RFB) are performed in accordance with the HBPP 10 CFR 50 license. On-site cask handling outside the RFB and storage activities associated with the ISFSI are performed in accordance with the 10 CFR 72 Humboldt Bay ISFSI license. As indicated in previous chapters, the Humboldt Bay ISFSI, in its final storage configuration, is a totally passive installation. Periodic surveillance is required only to check the material condition of the casks and vault interior. No degradation of the cask or vault interior is expected.

The operations described in this chapter relate to the loading and preparation of the multi-purpose canisters (MPCs) and the overpacks and transport of the loaded overpacks from the RFB to the ISFSI storage vault. Also described is the process for off-normal event recovery, including unloading of fuel from a loaded overpack. An overview of activities occurring in the HBPP RFB is provided. Specific licensing of the components and activities is provided in the 10 CFR 50 license amendment request (LAR) associated with dry spent fuel storage.

5.1 OPERATION DESCRIPTION

The methods and sequences described below provide an overview of the operational controls that the personnel performing spent fuel loading, MPC and overpack preparation for storage, cask transfer, onsite handling, and storage activities implement to ensure safe, reliable, long-term spent fuel storage at the ISFSI storage site. Site-specific procedures are used to implement these activities, including the use of existing procedures, revision of existing procedures, and the creation of new procedures, as necessary. The specific number, wording, and sequence of site procedural steps may vary from the guidance provided here as long as the steps comply with assumptions and inputs in the governing, design-basis analyses.

Operations to load and place the HI-STAR HB System at the storage location in the ISFSI vault are performed both inside and outside the HBPP RFB. MPC fuel loading and handling operations are performed inside the RFB using existing HBPP systems and equipment for radiation monitoring, decontamination, and auxiliary support, augmented as necessary by ancillary equipment specifically designed for MPC fuel loading and handling functions. This includes the use of the davit crane and cask transfer rail dolly for heavy lifts and other cask movements. The implementing procedures incorporate applicable 10 CFR 50 license conditions and commitments, such as those governing heavy loads and fuel movements in the spent fuel pool (SFP). MPC installation in the overpack and movement of the loaded overpack to the storage location are performed using procedures developed specifically for these operations.

5.1.1 NARRATIVE DESCRIPTION

The following discussion describes the specifics of the integrated operation, including fuel loading, MPC closure operations, overpack closure operations, HI-STAR HB System handling, and placement of the loaded overpack in the ISFSI vault. To the extent practicable, the same operations as used in deploying the generic HI-STAR 100 System are used with the HI-STAR HB System. Certain operating procedures have been customized for site-specific licensing at HBPP and the Humboldt Bay ISFSI.

The MPC is loaded, while in the HI-STAR HB overpack, in the SFP. The MPC is welded and prepared for storage while in the RFB. The MPC is sealed inside the overpack in the RFB and is then transported to the ISFSI vault for storage. Section 5.1.1.1 describes loading operations for damaged fuel. Section 5.1.1.2 describes fuel cask loading and sealing operations. Section 5.1.1.3 describes the operations for transferring the loaded HI-STAR HB System to the ISFSI storage site for storage. Section 5.1.1.4 describes off-normal event recovery operations. Section 5.1.1.5 describes greater-than-class C (GTCC) cask loading and sealing operations, and section 5.1.1.6 describes HI-STAR HB GTCC Overpack transfer to the ISFSI storage site.

Specific procedures identify and control the selection of fuel assemblies and greater than Class C waste (GTCC) for loading into the HI-STAR HB System or GTCC qualified casks, as appropriate. Fuel and GTCC will not be loaded in the same MPC. All HBPP fuel is acceptable for storage in the HI-STAR HB System based on a comparison of the fuel assemblies' physical characteristics against the limits specified in Section 10.2. The selected fuel assemblies are classified as intact fuel or damaged fuel in accordance with the definitions in Section 10.2, and the classification criteria described in Section 3.1.

Fuel assemblies chosen for loading are assigned a specific storage location in the MPC in accordance with the Humboldt Bay ISFSI TS and Section 10.2. The classification of the assembly (that is, intact or damaged) is used to determine the acceptable fuel storage locations for each assembly. Records are kept that track the fuel assembly, its assigned MPC, and its specific fuel storage location. Videotape (or other visual record) is used during fuel loading operations in the SFP to record fuel assembly serial numbers and to provide an independent record of the MPC inventory.

The loading, unloading, and handling operations described in this section were developed based on the Holtec International field experience in loading HI-STORM 100 and HI-STAR 100 dry cask storage systems at other ISFSIs. The equipment and operations used at these sites were evaluated and modified, as necessary, based on this experience to reduce occupational exposures and further enhance the human factors involved in performing the activities needed to successfully deploy the HI-STAR HB System at the Humboldt Bay ISFSI.

5.1.1.1 Damaged Fuel Loading

Damaged fuel containers (DFCs) are used to store damaged fuel assemblies in the MPC-HB in accordance with the requirements of the Humboldt Bay ISFSI TS and Section 10.2. Any qualified fuel assembly that is classified as damaged fuel must be stored in a DFC and be loaded into specific fuel storage locations in an MPC-HB. Two patterns for loading DFCs containing damaged fuel are permitted (see Section 10.2):

- Up to 28 DFCs around the basket periphery, or
- Up to 40 DFCs in a checkerboard pattern throughout the basket.

In both cases, the balance of fuel stored in an MPC must be intact fuel assemblies, optionally stored in DFCs themselves. Storage of damaged fuel in the HI-STAR HB System is discussed in Section 4.2.3.2.2 and the structural analysis of the containers is described in Section 4.3.2.2.10. Figure 4.2-3 shows the pertinent design details of the Humboldt Bay DFC.

5.1.1.2 Fuel Cask Loading and Sealing Operations

This section describes the general sequence of operations to load and seal the fuel cask, including the movement of the HI-STAR HB overpack within the RFB. Site-specific procedures control the performance of the operations, including inspection and testing. At a minimum, these procedures control the performance of activities and alert operators to changes in radiological conditions around the cask. These sequences are controlled by Humboldt Bay ISFSI TS and Section 10.2.

Several components (e.g., the davit crane and cask transfer rail dolly) are used during the cask loading process. A discussion of these items is provided for the sole purpose of describing the loading process. These items, along with their design and use, are described in the HBPP 10 CFR 50 LAR to support ISFSI operations in the RFB.

Placement of loaded HI-STAR HB overpacks in the ISFSI vault is a cyclical process involving the movement of a loaded overpack to the ISFSI and returning the empty cask transporter to the RFB for the next loading process. The operations described herein start at the time the empty MPC is loaded into the overpack and is ready for movement into the RFB.

Prior to bringing the HI-STAR HB overpack into the RFB, the overpack is visually verified to be free of foreign materials and the top lid sealing surface is visually inspected for potential damage. Also, an empty MPC has been cleaned, inspected, and inserted into the overpack. Alignment marks are checked to ensure correct rotational alignment between the MPC and the HI-STAR HB overpack.

The HI-STAR HB overpack containing an empty MPC is brought into the RFB in the vertical orientation through the railroad door on the cask transfer rail dolly that runs from inside the RFB to the Unit 3 yard. The cask transfer rail dolly is used because dimensional limitations of the RFB door prevent access of the cask transporter inside the RFB. After bringing the overpack into the RFB, the overpack is positioned under the davit crane that is configured with the lift yoke and the overpack annulus overpressure system is connected.

The overpack-to-MPC annulus is filled with clean water and the inflatable annulus seal is installed in the top part of the annulus to minimize the risk of contaminating the external shell of the MPC. The MPC internal cavity is filled with SFP water or water from another suitable source to prevent splash-back when the cask is lowered into the SFP. The lift yoke engages the overpack lifting trunnions and is used to raise and lower the overpack during loading operations inside the RFB.

The HI-STAR HB overpack is raised by the davit crane, positioned over the cask loading area of the SFP, and lowered using the davit crane hoist until the top the overpack is nearly level with the water level in the annulus overpressure system. The annulus overpressure system supply line to the overpack is opened and the overpack is lowered to the bottom of the SFP. The annulus overpressure system applies a slight overpressure to the annulus to protect the MPC external shell from contamination from the SFP water in the event there is a leak in the annulus seal. When the cask is fully lowered to the bottom of the cask loading area in the SFP, the lift yoke is remotely disconnected from the overpack and moved out of the way to allow fuel loading into the cask.

Fuel-loading and post-loading verification of correct fuel assembly placement in the MPC (i.e., assembly identification and storage cell location) is conducted in accordance with approved fuel-handling procedures. For damaged fuel assemblies, the assembly is loaded into the DFC, and the DFC is loaded into the MPC. Optionally, an empty DFC may be first loaded into the appropriate fuel storage location in the MPC and then the damaged fuel assembly may be loaded into the DFC. Intact fuel assemblies may be stored in DFCs at Pacific Gas and Electric's (PG&E) discretion.

The MPC lid, with the drain line attached, is placed in position in the MPC after the completion of fuel loading and verification, while the HI-STAR HB overpack is in the SFP. The lift devices are detached from the MPC lid allowing the lift yoke, which is attached to the davit crane, to be lowered to the overpack to engage the lifting trunnions. The overpack and lift yoke are raised until the top of the MPC and overpack break the water surface. The annulus overpressure supply line is closed and the overpressure system is disconnected. Initial decontamination of the overpack may be performed as the overpack emerges from the SFP or in any other manner approved by the Radiation Protection (RP) Department. The overpack is raised completely out of the SFP. The overpack is placed onto the cask transfer rail dolly in the cask washdown area. The lid retention device is attached. The lift yoke is disconnected and removed from the area.

The MPC water volume is reduced to provide enough space between the water surface and the lid to avoid a water-weld interaction. The inflatable annulus seal is removed and the annulus water level is lowered. Once the top edge of MPC shell is surveyed and found to be in satisfactory condition, the annulus shield is installed. The lid retention device remains in place until a sufficient number of tack welds are applied, and is then removed to allow room for the automatic weld system to be installed.

The space under the MPC lid is exhausted or purged during welding operations to prevent combustible gas concentrations that may result from the oxidation of the neutron absorber panels in the water. Appropriate monitoring for combustible gas concentrations is performed prior to and during MPC lid welding operations. The MPC lid-to-shell weld, including liquid penetrant inspections after the root pass, each approximately 3/8-inch of weld depth, and after the final pass, is then completed.

Once the lid-to-shell weld is complete, the MPC undergoes a pressure test for leaks in accordance with the ASME Code. The lid-to-shell weld is liquid penetrant inspected after the pressure test. Either prior to, or following successful completion of the pressure test (depending on whether a hydrotest or pneumatic test is performed), the Removable Valve Operating Assemblies (RVOAs) are installed and the remaining MPC water is displaced from the MPC by pumping or blowing pressurized nitrogen or helium gas into the MPC. The water may be drained from the overpack annulus and vacuum drying or the Forced Helium Dehydration (FHD) System is used to remove the remaining liquid water from the MPC and to ultimately reduce the moisture content of the MPC cavity to an acceptable level.

Following the successful completion of moisture removal from the MPC, the MPC is backfilled with helium to within the required pressure range. Helium backfill to the required pressure range ensures that the conditions for heat transfer inside the MPC are consistent with the thermal analyses and provides an inert atmosphere to ensure long-term fuel integrity. After successful helium backfill operations, the RVOAs are removed and the MPC vent and drain port cover plates are installed, welded, and examined. The MPC closure ring is then installed, welded, and examined.

The HI-STAR HB overpack and accessible portions of the MPC are checked to ensure any removable contamination is within applicable limits. Additional decontamination and surveys may be performed throughout the loading process. The closure plate is installed on the HI-STAR HB with the redundant mechanical seals, and the bolts are tightened to seat the seals. The overpack annulus is drained, if not previously completed, and dried using the vacuum drying system and the annulus is backfilled with helium in accordance with the Humboldt Bay ISFSI TS and Section 10.2.

The integrity of the closure plate mechanical seals is verified by performing a helium leakage test between the seals using the overpack test port. Upon successful completion of the seal leakage test, a test port plug and cover plate are installed. The overpack vent and drain ports are then sealed with port plugs and the port plugs are helium leakage tested. Upon successful testing of the port plugs, the vent and drain port covers are installed and the cask is ready for transport to the ISFSI storage vault.

The loaded overpack is moved out of the RFB along the rail dolly using a winch system or similar device and positioned under the lift beam of the cask transporter with the lift links attached.

5.1.1.3 Fuel Cask Transfer to the ISFSI Storage Site

The cask transporter is positioned outside the RFB doors to receive the HI-STAR HB overpack from the cask transport rail dolly. The transporter will have undergone preoperational testing and maintenance and is operated in accordance with the Cask Transportation Evaluation Program, which evaluates and controls the transportation of loaded overpacks between the HBPP RFB and ISFSI vault. The cask transporter lift links engage the HI-STAR HB lifting trunnions and the overpack is lifted off of the rail dolly. A restraining strap is used to secure the overpack to the transporter. The overpack is transported to the ISFSI vault along the approved transportation route using appropriate administrative controls as described in Section 4.3.3 and shown in Figure 2.2-2.

The cask transporter centers the HI-STAR HB overpack over the open vault storage cell. The restraining strap is released from the overpack. The cask transporter towers are used to lower the overpack down into the vault and the lift links are removed. The cask transporter is driven away from the ISFSI vault, the seismic shims are installed, and the storage cell lid is installed.

5.1.1.4 Off-Normal Event Recovery Operations

The evaluations of off-normal and accident events, as defined in ANSI/ANS-57.9 (Reference 1) and as applicable to the Humboldt Bay ISFSI, are presented in Chapter 8. Each postulated off-normal and accident event evaluated and discussed in Chapter 8 addresses the event cause, analysis, and consequences. Suggested corrective actions are also provided for off-normal events. The actual cause, consequences, corrective actions, and actions to prevent recurrence (if required) will be determined through the HBPP corrective action program on a case-specific basis. All corrective actions will be taken in a timely manner, commensurate with the safety significance of the event. Of primary importance in the early response to any event will be the verification of continued criticality prevention, the protection of fuel cladding integrity (that is, heat removal), and the adequacy of radiation shielding while longer-term corrective actions are developed. This may also involve the need for temporary shielding or cask cooling in accordance with the recommendations of PG&E technical staff personnel, based on the event conditions.

Should the need arise during the loading campaign, the MPC can be returned to the SFP for unloading. To unload a HI-STAR HB overpack, the operations described above are effectively executed in reverse order from the point in the operation at which the event occurred. Once the overpack is back in the RFB, the overpack closure plate is removed, and preparations are made to re-open the MPC in the SFP. This involves first installing the annulus shield and cutting or grinding out the welds to remove the MPC closure ring and vent and drain port cover plates.

Then, the bulk temperature of the gas in the MPC cavity is ensured to be below the maximum value to allow re-flooding. Given the age of the fuel at the time of loading, it is unlikely that the cavity gas will require cooling prior to re-flooding. Nevertheless, the bulk gas temperature will be determined and cooled using appropriate means, if necessary. Appropriate means could include recirculating water in the overpack annulus and/or helium recirculation with the FHD system to cool the MPC to a temperature at or below the maximum allowed temperature for re-flooding in accordance with the Humboldt Bay ISFSI TS and Section 10.2.

Ensuring the MPC cavity bulk gas temperature to be below the maximum allowed temperature allows the MPC to be re-flooded with water with a minimal amount of flashing and the associated undesirable pressure spikes in the MPC cavity. The weld removal system is used to cut the MPC lid weld. Once the lid weld is removed, the lid retention device is installed.

After re-flooding, appropriate monitoring for combustible gas concentrations shall be performed prior to, and during, MPC lid cutting operations to prevent the build-up of combustible mixtures caused by oxidation of neutron absorber panels contained in the MPC. In addition, the space below the MPC lid shall be exhausted prior to, and during, MPC lid welding operations to provide additional assurance that explosive gas mixtures will not develop in this space.

When the lid weld has been successfully cut, the annulus shield is removed. The annulus is filled with clean water and the annulus overpressure system and annulus seal are installed. The lift yoke is installed on the davit crane and attached to the overpack. The davit crane moves the overpack and MPC over the cask loading area of the SFP and lowers it to the SFP floor. As the top of the HI-STAR HB reaches a level approximately equal to the SFP level, the supply line from the annulus overpressure system is connected and opened. Once in the SFP, the lid retention device and the MPC lid are removed and the spent fuel assemblies are removed from the MPC and placed back into the wet storage racks as necessary.

5.1.1.5 GTCC Cask Loading and Sealing Operations

This section describes the general sequence of operations to load and seal the GTCC cask, including the movement of the HI-STAR HB GTCC Overpack within the RFB. Site-specific procedures control the performance of the operations, including inspection and testing. At a minimum, these procedures control the performance of activities and alert operators to changes in radiological conditions around the cask. These sequences are controlled by Humboldt Bay ISFSI TS and Section 10.2.

Several components (e.g., the RFB crane and cask transfer rail dolly) are used during the cask loading process. A discussion of these items is provided for the sole purpose of describing the loading process.

Prior to bringing the HI-STAR HB GTCC Overpack into the RFB, the overpack is visually verified to be free of foreign materials or physical damage. Also, the empty GTCC Waste Container (GWC) has been cleaned, inspected, and inserted into the overpack. Alignment marks are checked to ensure correct rotational alignment between the GWC and the overpack. The GWC is similar to the Multi-Purpose Canister (MPC) within a spent fuel cask and has an outer container welded to the bottom of the GWC. The GWC is shown in Figure 3.3-4.

The overpack containing an empty GWC is brought into the RFB in the vertical orientation through the railroad door on the cask transfer rail dolly that runs from inside the RFB to the Unit 3 yard. The cask transfer rail dolly is used because dimensional limitations of the RFB door prevent access of the cask transporter inside the RFB. After bringing the overpack into the RFB, the overpack is positioned under the RFB crane that is configured with the lift yoke and the overpack annulus overpressure system is connected.

The overpack-to-GWC annulus is filled with clean water and the inflatable annulus seal is installed in the top part of the annulus to minimize the risk of contaminating the external shell of the GWC. The GWC internal cavity is filled with SFP water or water from another suitable source to prevent splash-back when the cask is lowered into the SFP. The lift yoke engages the overpack lifting trunnions and is used to raise and lower the overpack during loading operations inside the RFB.

The overpack is raised by the RFB crane, positioned over the cask loading area of the SFP, and lowered using the RFB crane hoist until the top of the overpack is nearly level with the water level in the annulus overpressure system. The annulus overpressure system supply line to the overpack is opened and the overpack is lowered to the bottom of the SFP. The annulus overpressure system applies a slight overpressure to the annulus to protect the GWC external shell from contamination from the SFP water in the event there is a leak in the annulus seal. When the cask is fully lowered to the bottom of the cask loading area in the SFP, the lift yoke is remotely disconnected from the overpack and moved out of the way to allow loading GTCC waste into the cask.

Loading GTCC waste (including the process waste container and the irradiated hardware pieces) is conducted in accordance with approved procedures. The GTCC process waste contained in the PWC will be thermally processed offsite at a vendor's facility. A dry heating process known as dry-ashing will be used to remove organics and other hydrogen bearing components from the process waste to produce a dry concentrated residue. The residue will have sufficiently low hydrogen content to mitigate the formation of hydrogen gas from radiolytic decomposition in long term storage casks. This is needed to maintain hydrogen at less than 5 percent by volume of the PWC void space [USNRC Information Notice 84-72, Clarification of Conditions for Waste Shipments Subject to Hydrogen Gas Generation]. After the dry-ashing process is complete, the vendor will vacuum dry the PWC, install a mechanical seal and backfill the PWC with helium and conduct a leak test. The PWC will be returned to HBPP and stored in the spent fuel pool (SFP), a wet environment; however, the process waste contained in the PWC will remain dry. The PWC will eventually be loaded into the GWC in the SFP.

After the PWC has been loaded into the GWC, the activated metals will be loaded into the GWC. The GWC will be moved out of the SFP, drained, vacuum dried and backfilled with helium.

The GWC lid, with the drain line attached, is placed in position in the GWC after the completion of loading GTCC waste, while the overpack is in the SFP. The lift devices are detached from the GWC lid allowing the lift yoke, which is attached to the RFB crane, to be lowered to the overpack to engage the lifting trunnions. The overpack and lift yoke are raised until the top of the GWC and overpack break the water surface. The annulus overpressure supply line is closed and the overpressure system is disconnected. Initial decontamination of the overpack may be performed as the overpack emerges from the SFP or in any other manner approved by the Radiation Protection (RP) Department.

The overpack is raised completely out of the SFP. The overpack is placed onto the cask transfer rail dolly in the railroad bay. The lift yoke is disconnected and moved from the area.

The GWC water volume is reduced to provide enough space between the water surface and the lid to avoid a water-weld interaction. The inflatable annulus seal is removed and the annulus water level is lowered. Once the top edge of GWC shell is surveyed and found to be in satisfactory condition, the annulus shield is installed if required by Radiation Protection personnel for dose considerations.

Although no combustible gas is expected, the space under the GWC lid is exhausted or purged during welding operations to prevent combustible gas concentrations from accumulating. Appropriate monitoring for combustible gas concentration is performed prior to and during GWC lid welding operations. The GWC lid-to-shell weld is then completed, including liquid penetrant inspections after the root pass, each approximately 3/8-inch of weld depth, and after the final pass.

Once the lid-to-shell weld is complete, the GWC undergoes a pressure test for leaks in accordance with the ASME Code. The lid-to-shell weld is liquid penetrant inspected after the pressure test. Either prior to, or following successful completion of the pressure test (depending on whether a hydrotest or pneumatic test is performed), the Removable Valve Operating Assemblies (RVOAs) are installed and the remaining GWC water is displaced from the GWC by pumping or blowing pressurized nitrogen or helium gas into the GWC. The water may be drained from the overpack annulus and vacuum drying is used to remove the remaining liquid water from the GWC and to ultimately reduce the moisture content of the MPC cavity to an acceptable level.

Following the successful completion of moisture removal from the GWC, the GWC is backfilled with helium to a nominal pressure range of 10 to 15 psig. Helium backfill provides an inert atmosphere to ensure long-term waste integrity. After successful helium backfill operations, the RVOAs are removed and the GWC vent and drain port cover plates are installed, welded, and examined. The GWC closure ring is then installed, welded, and examined.

The overpack and accessible portions of the GWC are checked to ensure any removable contamination is within applicable limits. Additional decontamination and surveys may be performed throughout the loading process. The closure plate is installed on the overpack and the bolts are tightened as specified by the cask manufacturer.

The overpack annulus is drained, if not previously completed, and the cask is ready for transfer to the ISFSI storage vault. The loaded overpack is moved out of the RFB using the cask transport rail dolly and positioned under the lift beam of the cask transporter with the lift links attached.

5.1.1.6 GTCC Cask Transfer to the ISFSI Storage Site

The cask transporter is positioned outside the RFB doors to receive the HI-STAR HB GTCC overpack from the cask transport rail dolly. The cask transporter lift links engage the HI-STAR HB lifting trunnions and the overpack is lifted off of the rail dolly. A restraining strap is used to secure the overpack to the transporter. The overpack is transported to the ISFSI vault along the approved transportation route using appropriate administrative controls as described in Section 4.3.3 and shown in Figure 2.2-2.

The cask transporter centers the HI-STAR HB GTCC overpack over the open vault storage cell. The restraining strap is released from the overpack. The cask transporter towers are used to lower the overpack down into the vault and the lift links are removed. The cask transporter is driven away from the ISFSI vault, the seismic shims are installed, and the storage cell lid is installed.

5.1.2 IDENTIFICATION OF SUBJECTS FOR SAFETY AND RELIABILITY ANALYSIS

5.1.2.1 Criticality Prevention

A summary description of the principal design features, procedures, and special techniques used to preclude criticality in the design and operation of the HI-STAR HB System is provided in Section 3.3.1.4. Additional detail on the criticality design of the storage cask is provided in Section 4.2.3.3.7.

5.1.2.2 Instrumentation

Examples of measuring and test equipment (M&TE) used during the preparation of the cask for storage operations are listed in Table 5.1-1. Additional, or different M&TE, may be used as determined through the development of site-specific operating procedures, including the revision of those procedures as experience in cask loading operations is gained and the state of the art evolves.

No instrumentation is required to detect off-normal operations of the HI-STAR HB System while in its final storage configuration at the ISFSI storage site. The cask system is designed to maintain confinement integrity under all design-basis normal, off-normal, and accident conditions.

5.1.2.3 Maintenance Techniques

No periodic maintenance is required to ensure the safe, long term operation of the Humboldt Bay ISFSI. Any required corrective maintenance will be completed under the work control process.

5.1.3 REFERENCES

1. ANSI/ANS-57.9-1992, Design Criteria for an Independent Spent Fuel Storage Installation (dry type), American National Standards Institute.