UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
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June 9, 2003

Mr. Gregg R. Overbeck
Senior Vice President, Nuclear
Arizona Public Service Company
P.O. Box 52034
Phoenix, Arizona 85072-2034

SUBJECT: NRC INSPECTION REPORT 50-528/02-08; 50-529/02-08; 50-530/02-08; 72-44/02-03

Dear Mr. Overbeck:

NRC inspections were conducted between November 11, 2002, and March 21, 2003, at your Palo Verde nuclear reactor facility to evaluate the dry cask storage activities for your Independent Spent Fuel Storage Installation (ISFSI). These inspections included observation of activities associated with your pre-operational testing program and the loading of your first cask. The inspections were conducted to confirm compliance of your program and activities with the requirements specified in the license, technical specifications, Final Safety Analysis Report and the NRC's Safety Evaluation Report for the NAC-UMS cask system. The enclosed report presents the results of this inspection. Overall, the inspection found that activities were being performed in accordance with procedural and regulatory requirements. No violations of NRC regulations were identified.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

If you have any questions concerning this inspection, please contact Mr. Vincent Everett, Senior Health Physicist, at (817) 860-8198 or the undersigned at (817) 860-8191.

Sincerely,

/RA/

D. Blair Spitzberg, Chief
Fuel Cycle Decommissioning Branch

Docket Nos.: 50-528, 50-529, 50-530, 72-44
License Nos.: NPF-41, NPF-51, NPF-74

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Enclosure:
NRC Inspection Report
50-528/02-08; 50-529/02-08; 50-530/02-08; 72-44/02-03

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ADAMS: ✔ Yes ☐ No Initials: *JVE*
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DOCUMENT NAME: S:DNMS\Fcdb\jve\pv0208jve.wpd Final: R:_pv\2002\pv0208jve.wpd

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ENCLOSURE
U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket Nos.:	50-528, 50-529, 50-530, 72-44
License Nos.:	NPF-41, NPF-51, NPF-74
Report No:	50-528/02-08; 50-529/02-08; 50-530/02-08; 72-44/02-03
Licensee:	Arizona Public Service Company
Facility:	Palo Verde Nuclear Generating Station, Units 1, 2, and 3 Palo Verde Independent Spent Fuel Storage Installation
Location:	5951 S. Wintersburg Road, Tonopah, Arizona
Dates:	November 13-14, 2002 (Welding - exit conducted via phone on November 20, 2002) February 4-5, 2003 (Welding - exit on February 5, 2003) February 10-14, 2003 (Pre-operational demonstration, Part 1 - exit on February 14, 2003) February 25-27, 2003 (Pre-operational demonstration, Part 2 - exit on February 27, 2003 March 3-21, 2003 (Loading of first cask - exit conducted via phone on March 21, 2003)
Inspectors:	J. V. Everett, Team Leader, Region IV G. K. Morell, Health Physicist, Region IV J. F. Melfi, Resident Inspector G. G. Warnick, Resident Inspector E. M. Garcia, Health Physicist, Region IV L. E. Ellershaw, Senior Reactor Inspector, Region IV J. D. Parrott, Senior On-Site Representative, DWM R. R. Temps, Safety Inspector, SFPO J. E. Whittemore, Senior Reactor Inspector, Region IV J. A. Clark, Senior Project Engineer J. S. McAnallen, Nuclear Safety Intern, NMSS T. W. Dexter, Security Consultant
Approved By:	D. Blair Spitzberg, Ph. D., Chief, Fuel Cycle Decommissioning Branch
Attachment 1: Attachment 2:	Supplemental Information Inspector Notes
ADAMS Entry:	IR 05000528-02-08;05000529-02-08;05000530-02-08;07200044/02-03 on 11/13/02-03/21/03; Arizona Public Service; Palo Verde Nuclear Plant; ISFSI Report; No violations

EXECUTIVE SUMMARY

Palo Verde Nuclear Generating Station, Units 1, 2, and 3
NRC Inspection Report 50-528/02-08; 50-529/02-08; 50-530/02-08; 72-44/02-03

The Palo Verde Nuclear Generating Station had developed and implemented a dry cask storage program to begin removing spent fuel from the reactor spent fuel pools for storage at the Palo Verde Independent Spent Fuel Storage Installation (ISFSI). The ISFSI was located within the current reactor site exclusion area. The ISFSI pad was sized to eventually hold 336 casks. The current inventory of spent fuel at the three reactors would fill 81 casks. On March 3, 2003, the licensee began loading the first canister with spent fuel and on March 15, 2003, placed the loaded canister on the ISFSI pad. A second canister was placed on the ISFSI pad on April 15, 2003.

The licensee was using the NAC-UMS cask design. This consisted of a stainless steel canister in which the spent fuel was placed. The canister was welded shut and placed in a vertical concrete cask that was moved to the ISFSI pad by rail from the fuel building. All handling and movement of the canister prior to insertion into the concrete cask was performed with the canister inside the transfer cask. The steel transfer cask provided the necessary shielding of the canister to allow workers to perform duties near the canister including welding, vacuum drying, backfilling with helium and performing the necessary tests on the welds to ensure the quality of the weld.

The NRC conducted four onsite inspections of the activities associated with the licensee's pre-operational test program. In addition, the NRC provided 24-hour coverage of the loading, drying, helium backfilling and welding activities of the first cask. NRC Inspectors were also present for the heavy lift of the loaded canister from the cask loading pit, movement of the canister from the decontamination pit to the concrete cask and the lowering of the canister into the concrete cask. The NRC inspections focused on the licensee's efforts to demonstrate that adequate equipment, procedures and personnel were in-place to safely move spent fuel from the reactor spent fuel pools to the ISFSI. The pre-operational test requirements covered all key activities related to loading a cask and moving the cask to the ISFSI. Demonstrations also included the process for unloading spent fuel from a cask, should that be necessary. Throughout the demonstrations observed by the NRC, the Palo Verde staff functioned professionally and performed their assigned functions safely. The staff was well trained and had committed significant resources and time to preparing for the critical activities associated with safely moving spent fuel. Personnel interviewed during the inspections were enthusiastic about the effort at Palo Verde and presented a positive attitude toward safety.

The primary inspection procedures used for guidance during the pre-operational inspections were Inspection Procedure 60854 "Pre-operational Testing of an ISFSI," Inspection Procedure 60855 "Operations of an ISFSI," Inspection Procedure 60856 "Review of 10 CFR 72.212(b) Evaluations," Inspection Procedure 60857, "Review of 10 CFR 72.48 Evaluations," and Inspection Procedure 81001, "ISFSI Security." The NRC inspectors reviewed 15 key technical areas against the requirements in the NAC-UMS Final Safety Analysis Report, NAC-UMS Certificate of Compliance #1015, the technical specifications associated with the NAC-UMS cask design and 10 CFR Part 50, Part 72 and Part 73. Attachment 2 of this report provides the inspector notes documenting the findings in each of the technical areas reviewed. The following provides a summary of these

findings and conclusions.

- The reactor facility emergency planning program had been revised to incorporate provisions for responding to an emergency condition at the ISFSI (Attachment 2 - Emergency planning).

- The Pre-Fire Strategy Manual included the shed near the ISFSI pad, which was the only structure that required consideration for fire planning near the ISFSI pad. (Attachment 2 - Fire Protection).

- Provisions had been incorporated into procedures to limit flammable and explosive liquids near the loaded cask during movement from the fuel building to the ISFSI pad (Attachment 2 - Fire Protection).

- Classification criteria for determining whether spent fuel was damaged or intact had been incorporated into procedures and was consistent with the criteria established by the NRC. The licensee had spent fuel that was determined to be damaged but did not plan to load any of this fuel into the first round of cask loadings (Attachment 2- Fuel Verification).

- The NAC-UMS casks being used at Palo Verde were rated for heat loads up to 23 kW. Palo Verde had limited the heat load to 14 kW for the spent fuel selected for storage. This was necessary because the licensee did not have available a forced air cooling system required by Technical Specification A.3.1.4 for cooling casks greater than 14 kW if delays were encountered between completing the helium backfill of the canister and transferring the canister to the concrete cask (Attachment 2 - Fuel Verification).

- The licensee had completed an evaluation of the Palo Verde reactor programs to verify compliance with the conditions of the NAC-UMS cask design, Certificate of Compliance, Final Safety Analysis Report and requirements in 10 CFR Part 72. The evaluation included a review of the Palo Verde Part 50 programs related to emergency planning, radiation protection, training, quality assurance and various other programs. Several exemptions were requested and were received from the NRC related to seismic criteria for the ISFSI pad, contamination limits for the cask and record retention requirements (Attachment 2 - General License).

- The licensee had constructed an earthen berm around three sides of the ISFSI to reduce the dose rates to the public and to workers. Evaluation of the potential doses to members of the public from storage of spent fuel at the ISFSI pad determined that the radiation levels were well below the 25 mrem/year limit at the nearest exclusion area boundary for the site (Attachment 2 - General License).

- Evaluation of site environmental conditions determined that flooding and high/low temperature extremes would not present problems for storage of the spent fuel at the Palo Verde site (Attachment 2 - General License).

- The licensee had installed a new trolley for the fuel building crane and had conducted an extensive analysis and review to determine that no single failure of the new systems could result in failure of the crane to maintain the load. The new system included a below -the-hook lifting device called the SAFLIFT. The SAFLIFT replaced the yoke and slings that would normally be used for heavy load activities of moving the canister and transfer cask (Attachment 2 - Heavy Loads).

- The licensee had established a safe loads path for moving the loaded canister such that it was not moved over the spent fuel pool. The cask would be near the safety related air handling system in the fuel building when the loaded transfer cask was placed on top of the concrete cask for insertion of the canister. However, the single failure proof aspects of the new fuel building crane allowed the cask to be within the "zone of influence" around the air handling system (Attachment 2 - Heavy Loads).

- The licensee had incorporated into procedures the correct pressure requirements for helium backfill of the canister after drying (Attachment 2 - Hydro/Drying/Helium).

- The requirement for helium leak testing of the canister lid welds was incorporated into procedures. The acceptable leak rates for passing the test were consistent with the requirements in the technical specifications. Personnel assigned to performed the leak tests were qualified to the appropriate leak test certification requirements (Attachment 2 - Hydro/Drying/Helium).

- Vacuum drying time limits and acceptance criteria had been incorporated into procedures. The acceptance criteria had been adjusted to account for instrument error on the pressure gauge (Attachment 2 - Hydro/Drying/Helium).

- The licensee conducted an extensive pre-operational test program to prepare for the loading of the first cask. The NRC observed the required demonstrations during four inspection trips to the site. The first attempt to demonstrate welding of the canister lid resulted in a number of issues identified. As a result, Palo Verde conducted a second demonstration which resulted in a very high quality weld. Demonstrations related to heavy loads and the vacuum drying and helium backfill operations were very successfully performed. Personnel assigned to the ISFSI project were knowledgeable in their work assignments and the design aspects of the cask system and participated in the pre-operational tests realistically as if an actual canister was being loaded (Attachment 2 - Pre-Operational Tests).

- The licensee was required by the technical specifications to perform a heat characteristics test of the first cask with a heat load exceeding 10 kW. The licensee planned to load the third cask with spent fuel with a heat load of 10.17 kW and to conduct the required test. An appendix to the loading procedure included the instructions for conducting the test and reporting the results to the NRC (Appendix 2 - Procedures & Tech Specs).

- The licensee had incorporated the appropriate procedural information from Chapter 8 of the NAC-UMS Final Safety Analysis Report into the Palo Verde procedures for loading,

sealing, moving and unloading a cask. Written procedures for all activities related to cask loading and ISFSI operations had been developed (Attachment 2 - Procedures & Tech Specs).

- Verification of the operability of the temperature monitoring system for the casks on the ISFSI pad every 24 hours and confirmation that the temperature limits specified in the technical specifications were not exceeded had been incorporated into procedures (Appendix 2 - Procedures & Tech Specs).

- The reactor facility Part 50 quality assurance program was used for ISFSI activities. Structures, systems and components that were "important to safety" for ISFSI activities were identified and a graded quality assurance approach consistent with NRC guidance was applied (Appendix 2 - QA).

- The quality assurance program was being effectively implemented for procurement controls, control of measuring and test equipment, operating status, quality assurance audits, tracking problems and identifying corrective actions (Appendix 2 - QA).

- Strong radiological controls had been established to support cask activities. Observation during the pre-operational tests and during the loading of the first canister confirmed that the radiological staff had effectively evaluated the types of problems that could occur during cask activities and had made provisions to closely monitor workers and the work activities to minimize the spread of contamination and maintain radiological exposures ALARA (Attachment 2 - Radiological).

- Provisions had been established to account for the various neutron energy spectrums that could be encountered during the different phases of cask loading activities. Two neutron dosimeters were available for use. One for when the canister was inside the concrete cask and the neutrons spectrum was a lower energy due to the concrete shielding and another for when the canister was in the steel transfer cask. An extensive and well documented evaluation had been performed related to the neutron spectrum issue (Attachment 2 - Radiological).

- The licensee's records program had incorporated the various requirements for creating and maintaining ISFSI records. The required 90 day notice of intent to load fuel into the ISFSI had been received by the NRC as well as the 30 day notifications that the first two casks had been placed at the ISFSI (Attachment 2 - Records).

- A considerable amount of time during this inspection was directed toward review of safety evaluations associated with the ISFSI and in particular, the safety reviews associated with the replacement of the fuel building crane trolley. All safety reviews and screenings completed by the licensee were well documented with a good level of detail (Attachment 2 - Safety Reviews).

- The licensee had implemented an ISFSI security program consistent with the reactor facility security program including response to events, offsite support, training and

certification of security force personnel, lock and key controls and search requirements (Attachment 2 - Security).

- Intrusion and detection alarm systems for the ISFSI were tested Redacted per SUNSI 2005-31 and successfully detected attempts to enter the protected area. Redacted per SUNSI 2005-31 (Attachment 2 - Security).

- The training program for personnel assigned to the ISFSI provided a good basis for understanding the requirements and safe practices associated with dry cask loading operations (Attachment 2 - Training).

- Provisions had been established to monitor for hydrogen during cask lid welding. A value of 2.4 percent hydrogen had been established above which welding was not allowed (Attachment 2 - Welding).

- Personnel performing the welding were qualified to Section IX of the ASME Code and had been certified as either welders and/or welding operators for the gas tungsten arc welding process used at Palo Verde (Attachment 2 - Welding).

- Personnel performing the weld examinations were appropriately certified for liquid penetrant exams for both normal temperature weld examinations and high temperature weld examinations. Personnel were also certified for visual exams (Attachment 2 - Welding).

- Procurement and control of weld filler material was being performed in accordance with procedures and was adequately documented. This included both shim material and weld wire (Attachment 2 - Welding).

- Weld procedures were written and qualified in accordance with the requirements in Section IX of the ASME Code. Weld procedures had been reviewed and approved by Palo Verde (Attachment 2 - Welding).

ATTACHMENT 1

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INSPECTION PROCEDURES USED

60854	Preoperational Testing of an ISFSI
60855	Operations of an ISFSI
60856	Review of 10 CFR 72.212(b) Evaluations
60857	Review of 10 CFR 72.48 Evaluations
81001	ISFSI Security

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Discussed

None

Closed

None

LIST OF ACRONYMS

ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
APS	Arizona Public Service
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
B-10	Boron-10
CCTV	Closed Circuit Television
CFR	Code of Federal Regulations
CoC	Certificate of Compliance
CRDR	Condition Report/Disposition Request
dpm	disintegrations/minute
EPIP	Emergency Plan Implementing Procedure
ESD	Emergency Services Division
FSAR	Final Safety Analysis Report
GWD	Giga-Watt Days
ISFSI	Independent Spent Fuel Storage Installation
kW	kilowatt
MBA	Material Balance Accountability
MTU	Metric Tons Uranium
MPC	Multi-Purpose Canister
MWD	Mega-Watt Days
NAC	NAC International, Inc
NDE	Nondestructive Examination
NDT	Nondestructive Testing
NRC	Nuclear Regulatory Commission
PT	Liquid Penetrant Testing
PVNGS	Palo Verde Nuclear Generating Station
PWR	Pressurized Water Reactor
QA/QC	Quality Assurance/Quality Control

QAG	Quality Augmented
SNT-TC	American Society for Nondestructive Testing - Technical Council
SSCs	Structures, Systems and Components
SSE	Safe Shutdown Earthquake
SWMS	Site Wide Management System
TFR	Transfer Cask
TLD	Thermoluminescent Dosimeter
TSC	Transportable Storage Canister
UMS	Universal MPC System
UPS	Uninterruptible Power Supply
UT	Ultrasonic Testing
VCC	Vertical Concrete Cask
VT	Visual Testing
WSI	Welding Services Incorporated

ATTACHMENT 2
PALO VERDE ISFSI INSPECTION 72-44/2002-03
(Inspector Notes - Table of Content)

PALO VERDE ISFSI INSPECTION 72-44/2002-03
(INSPECTOR NOTES)

Category:	Emergency Planning **Topic:** Emergency Drills
Reference:	10 CFR Part 50, App E, Sect F.1
Requirement	The emergency program shall provide for the training of employees and exercising, by periodic drills, of radiation emergency plans to ensure that employees are familiar with their specific emergency response duties.
Finding:	Emergency drills were routinely conducted at the Palo Verde site to comply with the emergency planning requirements for the reactor facilities and to exercise and train emergency response personnel. The emergency drills typically contained radiological problems or the emergency response was complicated by radiological conditions. The emergency response organization at Palo Verde participated in several drills per year and were trained and equipped to handle any type of radiological problem that could occur at the ISFSI. An emergency preparedness drill was conducted on December 11, 2002. The drill did not specifically cover an emergency at the ISFSI, but was performed with the existence of the ISFSI pad taken into consideration.
Documents Reviewed:	(a) Emergency Preparedness Drill 02-D-FAC-12009, dated December 11, 2002 (b) Emergency Response Organization Team Drill Report dated December 11, 2002

Category:	Emergency Planning **Topic:** Emergency Plan Changes
Reference:	10 CFR 72.44(f)
Requirement	Within six months of any changes made to the emergency plan, the licensee shall submit a report containing a description of the changes to the appropriate regional office and HQ.
Finding:	Procedure EPIP-08, Section 3.1.1 required any changes made to the Palo Verde emergency plan to be submitted to the NRC within 30 days, consistent with the requirement in 10CFR50.54(q) for emergency plan changes made to reactor facility emergency plans. Since the Palo Verde ISFSI emergency program was incorporated into the Part 50 reactor emergency program, the six month submittal requirement in 10 CFR 72.44 (f) was met by the 30 day requirement in Procedure EPIP-08.
Documents Reviewed:	Procedure EPIP-08 "Emergency Plan Administration," Rev 10

Category:	Emergency Planning **Topic:** ISFSI Emergency Plan
Reference:	10 CFR 72.32(c)
Requirement	For an ISFSI that is located on the site of a nuclear power plant licensed for operation, the emergency plan required by 10CFR50.47 shall be deemed to satisfy the requirements of this section.
Finding:	The ISFSI had been incorporated into the Palo Verde reactor site emergency plan. The emergency plan included a definition of the ISFSI and a change in the protected area boundary showing the ISFSI. The emergency plan implementing procedures were also

updated to include the ISFSI. Changes to the emergency plan implementing procedures included a revised site map incorporating the ISFSI.

Documents Reviewed: PVNGS Emergency Plan, Summary of Changes, Rev 26

Category: Fire Protection **Topic:** Fire Protection Plan

Reference: 10 CFR 50.48(a)(1)

Requirement Each operating nuclear power plant must have a fire protection plan that satisfies Criterion 3 of Appendix A to Part 50. This fire protection plan must describe the overall fire protection program for the facility.

Finding: The Palo Verde pre-fire strategy manual, which included the fire protection program for the reactors, was revised on January 3, 2003 to incorporate the shed near the ISFSI pad. The shed was the only facility near the ISFSI pad that contained energized equipment. No flammable liquids were stored in the shed. Procedures related to the fire protection program were reviewed including control of combustionables, hot work permits and access to protected areas during drills and emergencies. The procedures were found to adequately address fire protection for the ISFSI. The licensee had documented in CRDR # 2569965 the discovery of a burned power conditioner in the ISFSI shed which had set off the local fire alarm and caused slight damage to adjacent components in the cabinet. The damaged equipment was part of the temperature monitoring system for pad #3. All damaged equipment was replaced.

Documents Reviewed: (a) Fire Protection Plan: Pre-Fire Strategy Manual, Rev 14 (b) Procedure 14DP-0FP05 "Ancillary Building Walkdown Procedure," Rev 6 (c) Procedure 14DP-0FP33 "Control of Transient Combustibles," Rev 10 (d) Procedure 14DP-0FP36 "Hot Work Permit," Rev 7 (e) Procedure 14DP-0FP22 "Access to Protected Area During Drills or Emergencies," Rev 5 (f) CRDR # 2569965 "ISFSI TMS Power Supply in the TMS Cabinet in the ISFSI Shed Burned Out and is Non-Functional," dated December 3, 2002

Category: Fire Protection **Topic:** Fire/Explosion Potential

Reference: CoC 1015, Tech Spec B.3.4.1.5

Requirement The potential for fire or explosion shall be addressed, based on site-specific considerations. This includes the condition that the fuel tank of the cask handling equipment used to move the loaded concrete cask onto or from the ISFSI site contain no more than 50 gallons of fuel.

Finding: The licensee had analyzed the fire/explosion potential for the ISFSI activities in the PVNGS Engineering Study A0-MS-B022 and had established administrative controls in Procedure 780P-9ZZ02 for cask loading and Procedure 780P-9ZZ03 for cask unloading to limit the amount of fuel to less than 50 gallons in the rail car mover, cask transporter or any vehicle within 65 feet of a loaded cask. A review was conducted of Procedure 780P-9ZZ02, Appendix L "Transport Path Pre-Move Inspection," which provided detailed instructions related to activities to be completed prior to moving a loaded cask from the fuel building to the ISFSI and included provisions for limiting fuel near the cask. In addition to the 50 gallon limit, Appendix L also specified that the 300 gallon and 1200 gallon on-site fuel trucks could not be within 115 feet and 180 feet, respectively, of a loaded cask. A table provided in Appendix L gave various distances

that would be applied to different quantities of flammable liquids, listing the minimum distances allowed between the explosive/flammable liquids and a loaded cask. The table included offsite bulk delivery trucks carrying flammable liquids, which were restricted from being within 360 feet of a loaded cask, and hydrogen delivery trucks, which were restricted to a 300 feet minimum distance.

Documents Reviewed: (a) Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 780P-9ZZ03 "NAC-UMS Cask Unloading Operations," Rev 1 (c) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (d) PVNGS Engineering Study A0-MS-B022 "ISFSI Fire Hazards Analysis (FHA)"

Category: Fire Protection **Topic:** Offsite Fire Support

Reference: 10 CFR 72.122(g)

Requirement Structures systems and components important to safety must be designed for emergencies. The design must provide for accessibility to the equipment of onsite and available offsite emergency facilities and services such as hospitals, fire and police departments, ambulance services, and other emergency agencies.

Finding: Procedure 14DP-0FP37 established a fire team captain in command of the licensee's fire team during an emergency. The fire team captain was responsible for the decision to activate offsite fire department assistance. The Phoenix fire department was used by Palo Verde for fire emergency back-up support. The Phoenix fire department had participated in several reactor facility drills at Palo Verde over the past several years. The latest participation was on October 27, 2002.

Documents Reviewed: (a) PVNGS Training Attendance Documentation, dated October 27, 2002 (b) Procedure 14DP-0FP37 "PVNGS Fire Department Incident Command System," Rev 3

Category: Fuel Verification **Topic:** Classifying Damaged Fuel

Reference: Interim Staff Guidance-1 (ISG-1)

Requirement Damaged fuel should be classified based on ISG-1 "Damaged Fuel."

Finding: Procedure 72DP-9NF02 incorporated the definition for intact and damaged fuel from the NRC's Spent Fuel Project Office Interim Staff Guidance Document-1 (ISG-1) into the criteria for selecting fuel for dry cask storage. Procedure 72DP-9NF02 currently limited fuel selection to only intact fuel for the first round of cask loadings. The procedure assigned the reactor engineering department the responsibility for selecting spent fuel assemblies for storage, specifying fuel assembly positions within the canister and retaining and transmitting required records to the nuclear information and records management system. Palo Verde had identified a number of Unit 2 fuel assemblies with an unusual crud condition which was referred to as "tenacious crud." Palo Verde's examination of the fuel with the tenacious crud indicated an oxidation thickness >80 micrometers (μm). Fuel currently acceptable for storage in the Palo Verde casks was limited to an oxidation thickness of no more than 80 μm. Therefore, none of the fuel with tenacious crud was currently eligible for dry cask storage. Ultrasonic testing and visual examinations were performed on all fuel assemblies selected for the first few canisters. These examinations were used to help classify the fuel. The visual and

ultrasonic testing inspections of the fuel with the tenacious crud indicated the fuel had through-wall penetrations, resulting in the fuel being classified as damaged fuel per the definitions in Procedure 72DP-9NF02 and ISG-1. The ultrasonic testing and visual examinations results eliminated these assemblies from consideration for the first evolution of dry cask storage. The ultrasonic testing indicated that water was present inside some of the fuel rods.

Documents Reviewed: (a) Procedure 72DP-9NF01 "Control of SNM Transfer and Inventory," Rev 10 (b) Procedure 72DP-9NF02 "Fuel Assembly Selection for Dry Cask Storage," Rev 3 (c) Procedure 78TI-9RX01 "Spent Fuel Inspection," Rev 3 (d) CRDR #2329443 "Root Cause Investigation of Fuel Failures at Palo Verde Nuclear Generating Station Unit 2 Discovered Between Nov 1999 and Oct 2000," Rev 0 (e) NRC Interim Staff Guidance-1 (ISG-1) "Damaged Fuel," Rev 1

Category: Fuel Verification **Topic:** Fuel Assembly Minimum Length

Reference: CoC 1015, App B Tech Spec B.3.2.1(b)

Requirement The minimum length of the intact fuel assembly internal structure and bottom end fitting and/or spacers shall ensure the minimum distance to the fuel region from the base of the canister is 3.2" for PWR fuel.

Finding: Procedure 72DP-9NF02, Appendix A contained the 3.2" criteria for the minimum distance to the fuel region from the base of the canister. A review of Analysis No. RE-02-C11-2003-001and Drawing No. N001-0203-00255-00 verified that the distance requirement was met for the Palo Verde fuel assemblies.

Documents Reviewed: (a) Procedure 72DP-9NF02 "Fuel Assembly Selection for Dry Cask Storage," Rev 3 (b) Analysis No. RE-02-C11-2003-001 "U2C11 Spent Fuel Selection for Dry Cask Storage" (c) Drawing No. N001-0203-00255-00 "Fuel Bundle Assay, System 80"

Category: Fuel Verification **Topic:** Fuel Loading - Preferential Loading

Reference: CoC 1015, Tech Spec B.2.1.2

Requirement Canisters containing fuel assemblies with cooling times between 5 yrs and 7 yrs must be preferentially loaded based on cooling times.

Finding: Analysis No. RE-02-C11-2003-001, which identified the spent fuel selected for storage from Unit 2, did not identify any fuel with a cooling time of less than 7 years. However, a preferential loading scheme based on cooling time was allowed for in Procedure 72DP-9NF02. The procedure specified that assemblies with higher dose rates (shorter cooling times, higher burn-up) were to be placed preferentially in the interior positions of the canister.

Documents Reviewed: (a) Procedure 72DP-9NF02 "Fuel Assembly Selection for Dry Cask Storage," Rev 3 (b) Analysis No. RE-02-C11-2003-001 "U2C11 Spent Fuel Selection for Dry Cask Storage"

Category: Fuel Verification **Topic:** Fuel Specifications

Reference: CoC 1015, Tech Spec B.2.1.1

Requirement Intact fuel assemblies meeting the limits specified by Tables B.2-1 through B.2-5 may be

stored in the NAC-UMS canister.

Finding: The parameters for the fuel selected for the first and second canisters were compared to the limits specified in Technical Specification B.2.1.1 and Tables B.2-1, B.2-2 and B.2-4 and were found to be within the limits required by the technical specification and tables. The values reviewed included: (1) decay heat per assembly (limit 958.3 watts): Cask #1 and #2 - 556 watts, (2) enrichment (limit 4.2% max/1.9% min): Cask #1 and #2 - 4.0334% maximum, 1.919%minimum, (3) post irradiation cooling time (limit 8 years min): Cask #1 and #2 - 9.7 years minimum, 14.7 years maximum, (4) highest burn-up (limit 45 GWD/MTU): Cask #1 - 42.028 GWD/MTU, Cask #2 - 41.841 GWD/MTU.

Documents Reviewed: (a) Analysis No. RE-02-C11-2003-001 "U2C11 Spent Fuel Selection for Dry Cask Storage" (b) NAC-UMS Certificate of Compliance #1015, Appendix B, Technical Specification B.2.1.1 "Fuel to be Stored in the NAC-UMS System," Table B.2-1 "Fuel Assembly Limits (PWR)," Table B.2-2 "PWR Fuel Assembly Characteristics," and Table B.2-4 "Minimum Cooling Time Versus Burnup/Initial Enrichment for PWR Fuel"

Category: Fuel Verification **Topic:** High Burn-up Fuel

Reference: CoC 1015, Tech Spec A.5.7

Requirement A verification program is required to determine the oxide layer thickness on high burnup fuel by measurement or statistical analysis for any fuel between 45,000 MWD/MTU and 50,000 MWD/MTU. Technical Specification A.5.7 gives specific criteria for the verification program.

Finding: The fuel selection criteria in Procedure 72DP-9NF02 limited the fuel to be loaded into the Palo Verde casks to a maximum fuel burn-up of 45,000 MWD/MTU. A review of Analysis No. RE-02-C11-2003-001 did not identify any fuel with burn-up greater than 45,000 MWD/MTU identified for loading in the Palo Verde casks. The licensee had not yet developed a verification program for determining oxide layer thickness on high burn-up fuel since no high burn-up fuel was planned for loading into casks during this loading evolution.

Documents Reviewed: (a) Procedure 72DP-9NF02 "Fuel Assembly Selection for Dry Cask Storage," Rev 3 (b) Analysis No. RE-02-C11-2003-001 "U2C11 Spent Fuel Selection for Dry Cask Storage"

Category: Fuel Verification **Topic:** Material Balance, Inventory, and Records

Reference: 10 CFR 72.72(a)

Requirement Each licensee shall keep records showing the receipt, inventory (including location), disposal, acquisition and transfer of all SNM with quantities specified in 10 CFR 74.13(a)(1).

Finding: Provisions were incorporated into Procedure 72DP-9NF01 to require accounting for the transfer of spent fuel to the ISFSI. Section 3.1.4.2 of the procedure required the special nuclear material inventory in each canister to be confirmed and documented. The reactor engineering department completed a material balance accountability (MBA) transfer set form listing the spent fuel assemblies, by fuel ID number, that were scheduled for loading into the canister and the position in the canister for each assembly. As the spent fuel was loaded, Procedure 78OP-9ZZ02, Step 7.1.9 required completion of Appendix I "TSC Fuel Loading Positions," which identified which spent

fuel assembly was actually placed in each of the 24 positions inside the canister. Step 7.1.11 required a post loading visual verification of the fuel assembly serial numbers against the approved fuel loading pattern and orientation. Step 7.1.12 required notification of the reactor engineering department to perform an independent verification of the correct loading of the canister by comparing the MBA transfer set form against the TSC fuel loading position form. After movement of the canister to the ISFSI pad, the ISFSI inventory document, as described in Section 3.18 of Procedure 72DP-9NF01, was used to identify the pad location where the canister was placed and the canister contents, including the individual fuel assembly ID number assigned to each canister cell location.

Documents Reviewed: (a) Procedure 72DP-9NF01 "Control of SNM Transfer and Inventory," Rev 10 (b) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category: Fuel Verification **Topic:** Maximum UO2 Weight/Assembly

Reference: FSAR 1015, Sect 1.3.1.4

Requirement The maximum UO2 weight (MTU) shall not exceed 11.53 MTU for PWR fuel assemblies.

Finding: Procedure 72DP-9NF02, Appendix A limited the UO2 weight (MTU) for each fuel assembly selected for storage to 0.442 MTU. A total of 24 assemblies at this weight would equal 10.608 MTU. This is below the 11.53 MTU limit specified in the NAC-UMS Final Safety Analysis Report. Analysis No. RE-02-C11-2003-001 listed the highest value for any of the Unit 2 spent fuel assemblies as 0.428882 MTU.

Documents Reviewed: (a) Procedure 72DP-9NF02 "Fuel Assembly Selection for Dry Cask Storage," Rev 3 (b) Analysis No. RE-02-C11-2003-001 "U2C11 Spent Fuel Selection for Dry Cask Storage"

Category: Fuel Verification **Topic:** Total Decay Heat Limit of 23 kW

Reference: FSAR 1015, Sect 1.3.1.2

Requirement The total decay heat of the stored PWR fuel shall not exceed 23 kW

Finding: Palo Verde limited their cask heat load to 14 kW. The calculated decay heat for the first two canisters was reviewed and found to comply with the 14 kW limit specified in Procedure 78OP-9ZZ02, Step 3.17. The 14 kW limit was imposed by Palo Verde because of the current lack of a forced air cooling system that would be required by Technical Specification 3.1.4 for cooling any canister that exceeded the technical specification limit for maximum time in the transfer cask. Canisters with heat loads less than 14 kW did not have a maximum time limit requirement. Analysis No. RE-02-C11-2003-001 provided calculations for the decay heat for the spent fuel planned for loading in the Palo Verde canisters. The first two canisters will be loaded with spent fuel from Unit 2. The first canister will have a total decay heat load of 7.587 kW. The second canister will have a decay heat load of 7.764 kW. The individual spent fuel assemblies in each canister with the highest heat value also complied with the 0.9583 kW/assembly limit specified in Table B.2-1 of the technical specification. The hottest individual assembly in both canisters had a decay heat value of 0.557 kW.

Documents Reviewed: (a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Analysis No. RE-02-C11-2003-001 "U2C11 Spent Fuel Selection for Dry Cask Storage"

Category:	General License **Topic:** Evaluation of Effluents/Direct Radiation
Reference:	10 CFR 72.212(b)(2)(i)(C) & 10 CFR 72.104
Requirement	The general licensee shall perform a written evaluation prior to use that establishes that the requirements of 10CFR72.104 "Criteria for Radioactive Materials in Effluents and Direct Radiation from an ISFSI" have been met. 10 CFR 72.104 requires the annual dose equivalent to any real individual who is located beyond the controlled area must not exceed 25 mrem to the whole body, 75 mrem to the thyroid and 25 mrem to any other critical organ during normal operations and anticipated occurrences.
Finding:	The licensee had incorporated an evaluation of normal and anticipated radiological doses to the public into Section 4.0 of the ISFSI 72.212 Evaluation Report to verify that the doses would be substantially less than the Part 72.104 limits. A review of the ISFSI 72.212 Evaluation Report concluded that the licensee had performed the appropriate analysis to verify that the total dose contribution from sources related to the ISFSI and operation of Units 1, 2 and 3 were less than the limits specified in 10 CFR 72.104. The minimum distance from the pad to the exclusion area boundary (controlled area) was approximately 4000 feet. Site specific analysis was performed using the current ISFSI pad capacity of 81 casks. The annual whole body dose from direct and scattered radiation, assuming an individual remained for 8766 hours/year at the exclusion area boundary, was calculated to be approximately 0.011 millirem/year. The whole body dose contribution due to cask surface alpha and gamma contamination was calculated to be approximately 0.0000012 millirem/year. The contamination estimates were based on a future loading at the ISFSI of 336 casks with all casks contaminated with the maximum allowable contamination levels allowed by Technical Specification A.3.2.1. The licensee had incorporated ALARA concepts in the design and construction of the ISFSI by placing the facility away from areas normally occupied by workers and by constructing an earthen berm around three sides of the ISFSI pad to reduce direct and scattered radiation to nearby areas.
Documents Reviewed:	"Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0

Category:	General License **Topic:** Flood Conditions
Reference:	CoC 1015, Tech Spec B.3.4.1.4
Requirement	An analyzed flood condition of 15 feet/sec water velocity and a height of 50 feet of water (full submergence of the loaded cask) will not be exceeded.
Finding:	Palo Verde Nuclear Generating Station's Updated Final Safety Analysis Report, Section 2.4.3 stated that the ISFSI site elevation was 150 feet above the site's maximum probable flood level. The ISFSI 72.212 Evaluation Report stated in Section 2.4.2.4.4 that flooding of the site was not a credible event.
Documents Reviewed:	(a) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (b) PVNGS Updated Final Safety Analysis Report

Category:	General License	**Topic:**	Initial Compliance Evaluation Against CoC
Reference:	10 CFR 72.212(b)(2)(i)(A)		
Requirement	A general licensee shall perform written evaluations, prior to use, that establish that the conditions set forth in the Certificate of Compliance have been met.		
Finding:	The licensee had included in their ISFSI 72.212 Evaluation Report a review of the requirements in the NAC-UMS Certificate of Compliance and 10 CFR Part 72. This review was documented as Section 2.0 of the evaluation report and included an assessment of the requirements from: 10 CFR Part 72; the NAC-UMS Certificate of Compliance No. 1015, Amendment 2; Appendix A to the Certificate of Compliance "NAC-UMS Technical Specifications;" and Appendix B to the Certificate of Compliance "NAC-UMS Approved Contents and Design Features." Each of the nine conditions in the certificate of compliance were individually reviewed. Palo Verde documented compliance with each of the license conditions which included requirements related to heavy loads, operating procedures, maintenance program, cask design and authorization to implement a dry cask storage program under the general license requirements of 10 CFR Part 72. The review of Appendix A and B of the Certificate of Compliance and the conditions in 10 CFR Part 72 included the seismic characteristics of the ISFSI pad, effluent and direct radiation levels associated with the storage of the casks at the ISFSI and the security and records requirements associated with the ISFSI. These reviews were documented in Sections 2.0, 3.0, 4.0, 7.0 and 9.0 of the evaluation report. One requirement related to 10 CFR Part 72 and two requirements in the technical specifications were the basis for exemption requests by Palo Verde. The 10 CFR Part 72 issue related to the requirement for duplicate records in 10 CFR 72.72(d). Palo Verde obtained an exemption from this requirement, documented in an NRC letter dated September 27, 2002, which allowed Palo Verde to maintain a single set of records in accordance with 10 CFR 50.71(d)(1). The issues related to the technical specifications involved the contamination limits for the canister specified in Technical Specification A.3.2.1 and the vertical seismic design limits for the ISFSI pad specified in Technical Specification B.3.4.1.3. Palo Verde requested a higher contamination limit and a higher vertical seismic design limit. The NRC approved the higher limits by letter dated October 30, 2002.		
Documents Reviewed:	(a) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (b) NRC Letter to APS entitled "Exemption from the Requirements of 10 CFR 72.212 and 72.214 for Dry Cask Storage," dated October 30, 2002 (c) NRC Letter to APS entitled "Issuance of an Exemption from the Recordkeeping Requirements of 10 CFR 72.72(d)," dated September 27, 2002		

Category:	General License	**Topic:**	Initial Compliance Evaluation Against FSAR
Reference:	10 CFR 72.212(b)(3)		
Requirement	The general licensee shall review the FSAR referenced in the CoC and the related NRC Safety Evaluation Report, prior to use of the general license, to determine whether or not the reactor site parameters, including analysis of earthquake intensity and tornado missiles, are enveloped by the cask design basis considered in these reports. The results of this review must be documented in the evaluation made in paragraph 72.212(b)(2).		

Finding: The licensee had included in their ISFSI 72.212 Evaluation Report a review of the requirements in the FSAR. This review was documented as Sections 3.0 and 5.0 of the evaluation report and included an evaluation of site specific parameters such as tornados, floods, earthquakes, site temperature extremes, lightning, fires and explosions. Section 2.2.2 of the evaluation report documented a number of differences between the planned operations at Palo Verde compared to the equipment and plant layout design discussed in the FSAR. These differences included the operations associated with the cask loading pit, the type of ancillary equipment planned for use during canister drying and backfilling, the shield lid lift ring, the use of the SAFLIFT hoist system, the use of a rail car instead of a heavy haul trailer and the use of the cask transporter instead of air pads. Palo Verde had performed 10 CFR 72.48 safety evaluations for each of the differences. The operations and equipment identified by Palo Verde as being different than the FSAR were observed during the pre-operational test demonstrations by the NRC. No concerns were identified by the NRC inspection team. The licensee discussed the seismic design of the ISFSI pad in Section 3.0 and 2.4.2.4.3 of the evaluation report. The vertical seismic design limit in Technical Specification B.3.4.3 was 0.173g. The safe shutdown earthquake (SSE) described in Section 3.7 of the reactor facility Updated Final Safety Analysis Report listed the SSE value for the vertical seismic acceleration level for the Palo Verde site as 0.20g. By letter dated February 4, 2002, NAC submitted to the NRC a revised seismic stability analysis requirement for the NAC-UMS FSAR, Section 11.2.8.2 to support a vertical seismic design limit of 0.26g for a corresponding 0.35 coefficient of friction and 0.29g for a corresponding 0.40 coefficient of friction. The Palo Verde pad had a 0.35 coefficient of friction. The NAC letter also proposed changes to Chapter 12, Section B.3.4.3 which was the FSAR version of Technical Specification B.3.4.3. The NRC performed a safety evaluation of the proposed seismic change and approved the new vertical seismic design limit for use at Palo Verde in a letter dated October 30, 2002.

Documents Reviewed: (a) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (b) NRC Letter to APS entitled "Exemption from the Requirements of 10 CFR 72.212 and 72.214 for Dry Cask Storage," dated October 30, 2002 (c) NAC Letter to NRC "Submittal of Supplemental Safety Analysis Report Changed Pages for an Amendment of the Certificate of Compliance for the NAC-UMS Universal Storage System to Incorporate Enhanced Design Features," date February 4, 2002

Category: General License **Topic:** Initial Evaluation Against Part 50 License

Reference: 10 CFR 72.212(b)(4)

Requirement Prior to use of the general license, determine whether activities related to storage of spent fuel involve a change in the facility technical specifications or require a license amendment for the facility pursuant to Part 50.59(c)(2). Results of this determination must be documented in the evaluation made in paragraph 72.212(b)(2).

Finding: The licensee had included in their ISFSI 72.212 Evaluation Report a review of the activities related to the storage of spent fuel under a general license and determined that a change to the reactor facility license and technical specifications was not required. The licensee performed a number of 10 CFR 50.59 safety evaluations to determine if proposed activities would affect plant operations. Evaluations were performed for the fuel building bridge crane/heavy loads program, transportation route between the fuel

building and the ISFSI pad, fuel building operations and ISFSI activities.

Documents Reviewed: "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0

Category: General License **Topic:** Program Review - RP, EP, QA, and Training

Reference: 10 CFR 72.212(b)(6)

Requirement The general licensee shall review the reactor emergency plan, quality assurance program, training program and radiation protection program to determine if their effectiveness is decreased and, if so, prepare the necessary changes and seek and obtain the necessary approvals.

Finding: The licensee had included in their ISFSI 72.212 Evaluation Report a review of the reactor emergency plan, quality assurance program, training program and radiation protection program. These program reviews were included as Sections 4.0 and 8.0 of the evaluation report. All four programs required revision to incorporate ISFSI specific information such as emergency plan response actions for an event at the ISFSI, determination of the items that were "important to safety" and need appropriate quality assurance controls, training modules for conducting ISFSI related activities and radiation protection controls for working around the casks. None of the changes adversely affected the existing reactor programs but were, in effect, extensions of the already existing programs. Observations during the pre-operational testing demonstration confirmed that the activities associated with the ISFSI were effectively incorporated into the existing reactor programs.

Documents Reviewed: "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0

Category: General License **Topic:** Shield Walls or Berms Around ISFSI

Reference: CoC 1015, Tech Spec B.3.4.1.7

Requirement In cases where engineering features (i.e. berms, shield walls) are used to ensure that requirements of 10 CFR 72.104(a) are met, such features are to be considered important to safety and must be evaluated to determine the applicable QA category on a site specific basis.

Finding: The earthen berm around the ISFSI had been identified as an important to safety item and was designed and constructed as Quality Augmented (QAG). This was a category in Palo Verde's quality assurance system that imposed specific quality assurance program elements on the activity. Per 81DP-0CC28, QAG was defined as an item that does not perform a safety related function but, as a result of regulatory commitment or management directive, required the application of certain quality assurance program elements. Quality assurance requirements had been imposed on procurement activities including audit and selection of the construction contractor. Credit for the existence of the berm had been incorporated into the licensee's calculations for demonstrating compliance with 10 CFR 72.104(a) dose limits to individuals beyond the controlled area. The assumptions for determining compliance with the dose limits were provided in Section 4.3.1 of the ISFSI 72.212 Evaluation Report.

Documents Reviewed:	(a) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (b) Procedure 81DP-0CC28 "Classification of Structures, Systems, and Components," Rev 7 (c) Audit Report A-PIZI-01-15 "Comments/Results of the Review of Pizzagalli Project Quality Manual"

Category:	General License **Topic:** Temperature Average for Site
Reference:	CoC 1015, Tech Spec B.3.4.1.1
Requirement	The temperature of 76 degrees F is the maximum average yearly temperature. The 3-day average ambient temperature shall be 106 degrees F or less.
Finding:	Engineering Study A0-MS-B019 reviewed the National Climate Data Center temperatures for Buckeye, Arizona between 1961 and 1990 and the Palo Verde site specific temperature data for 1987 to 1996 to verified that the site average temperatures were bounded by the limits specified in Technical Specification B.3.4.1.1. Specifically, the maximum average yearly temperature for Buckeye was 73.3 degrees F and for Palo Verde was 73.8 degrees F. The maximum 3-day average ambient temperature was 103.5 degrees F for Buckey and 104.9 degrees F for Palo Verde. These temperatures were below the 76 degrees F and 106 degrees F limits in the technical specification. This information was also included in the Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report, Section 2.4.2.4.1.
Documents Reviewed:	(a) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (b) PVNGS Engineering Study A0-MS-B019 "Dry Fuel Storage Site Temperature Parameters" (c) PVNGS Updated Final Safety Analysis Report

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Category:	General License **Topic:** Temperature Extremes for the Site
Reference:	CoC 1015, Tech Spec B.3.4.1.2
Requirement	The allowable temperature extremes, averaged over a 3-day period, shall be greater than minus 40 degrees F and less than 133 degrees F.
Finding:	The National Climate Data Center temperature extremes for Buckeye, Arizona and the temperatures for the Palo Verde site were reviewed in PVNGS Engineering Study A0-MS-B019 and found to be bounded by the limits specified in Technical Specification B.3.4.1.2. Specifically, the extreme temperatures, averaged over a 3-day period were 29 degrees F minimum and 112.4 degrees F maximum for Buckeye and 19.1 degrees F minimum and 119.2 degrees F maximum for the Palo Verde site. These temperatures were within the -40 degrees F minimum and 133 degrees F maximum specified in the technical specification. The Buckeye temperature values were for the years 1961 to 1990. The Palo Verde temperatures were for the years 1987 to 1996. This information was also included in the ISFSI 72.212 Evaluation Report, Section 2.4.2.4.2.
Documents Reviewed:	(a) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (b) PVNGS Engineering Study A0-MS-B019 "Dry Fuel Storage Site Temperature Parameters" (c) PVNGS Updated Final Safety Analysis Report

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Category:	Heavy Loads	**Topic:**	Canister Hoist Ring Thread Engagement

Reference: FSAR 1015, Sect 3.4.3.2

Requirement The canister structural lid hoist rings shall be threaded into the canister lid with at least 2" of thread engagement.

Finding: The canister structural lid hoist rings were designed to have a 3 inch minimum thread engagement into the canister lid. This design value of 3 inches exceeded the required 2 inch thread engagement.

Documents Reviewed: (a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 78OP-9ZZ01 "NAC-UMS Operations Dry Run," Rev 3 (c) Procedure 13-CN383A-A00012-0 "Dry Cask Storage Project - SAFLIFT Structural Evaluation of Canister Lift Ring" (d) Procedure 13-CN383A-A00020-1 "Dry Cask Storage Project - SAFLIFT Strongback Canister Hoist General Arrangement"

Category:	Heavy Loads	**Topic:**	Canister Hoist Rings

Reference: FSAR 1015, Sect 3.4.3.2

Requirement The hoist rings for the canister are American Drill Bushing Co. Model 23200 Safety Engineered Hoist Rings rated at 30,000 lbs (or comparable ring from an alternate manufacturer) with a safety factor of 5 on ultimate strength.

Finding: The hoist ring concept described in the NAC-UMS Final Safety Analysis Report was not used at Palo Verde. The licensee performed a 10 CFR 72.48 screening and determined that their alternate special lifting device, referred to as SAFLIFT, met the requirements to be considered single failure proof. The canister hoist and grapple complied with the design basis described in NUREG-0554 "Single Failure Proof Cranes for Nuclear Power Plants," and NUREG-0612 "Control of Heavy Loads at Nuclear Power Plants," Appendix C. These components were tested by Fritz Testing Laboratory as part of the SAFLIFT factory testing in September, 2002. The canister hoist and grapple were successfully tested to a load test weight that exceeded 300 percent of the anticipated maximum canister weight. This test was consistent with the requirements specified in ANSI N14.6, Section 7 for special lifting devices for critical loads.

Documents Reviewed: (a) 10 CFR 72.48 Screening #S-02-009 "Dry Cask Storage Project - Impact of SAFLIFT Grapple Weight on TSC, TFR, and VCC," Rev 0 (b) 10 CFR 72.48 Screening #S-03-002 "Dry Fuel Storage Special Lifting Devices," Rev 0 (c) ANSI N14.6 "Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds or More," 1993

Category:	Heavy Loads	**Topic:**	Heavy Loads Safety Evaluation

Reference: CoC 1015, Condition 5

Requirement A plant specific safety review (50.59/72.48) is required to show operational compliance with existing plant specific heavy loads requirements.

Finding: An extensive review of the heavy loads program at Palo Verde was performed including the licensee's recent upgrade of their fuel building crane to qualify the crane as single failure proof. The licensee had completed a number of safety evaluations concerning modifications to the fuel building crane and had performed a thorough analysis of the various loads associated with the dry cask storage project. The loads evaluated were

consistent with the estimates provided in the NAC-UMS Final Safety Analysis Report, Section 3.2, Tables 3.2-1 and 3.2-3. The fuel building crane was a single trolley Seismic Category I overhead crane with a 150-ton capacity main hoist and a span of approximately 77.5 feet. The auxiliary hoist had a capacity of 15-tons. The cranes had been recently modified by replacing the existing trolley with a single failure proof trolley. An analysis was performed by American Crane and Equipment Corp. and documented as Report REP-20016-002 using the guidance in NUREG-0612 "Control of Heavy Loads at Nuclear Power Plants" and NUREG-0554 "Single Failure Proof Cranes for Nuclear Power Plants" to verify that a single failure of a critical component of the new Palo Verde trolley would not result in loss of capability to retain or handle the heavy load. The licensee's program for implementing control of heavy load lifts and maintenance of crane equipment was described in several procedures and documents. These procedures and documents contained sufficient guidance and incorporated applicable requirements specified in the NAC-UMS Final Safety Analysis Report, ANSI documents, NUREG guidelines and the NAC-UMS Certificate of Compliance. The licensee's ISFSI system design, load transport equipment and the program for planning and implementing the lifting and transport of the heavy loads associated with moving the spent fuel from the fuel building to the ISFSI was found to be comprehensive and well documented. To review the adequacy of the heavy loads program related to the operations of the spent fuel transfer system, the NRC inspectors observed the pre-operational test of the spent fuel lifting and transfer system performed per Procedure 78OP-9ZZ02. The various evolutions observed included: transferring a weighted canister into the transfer cask, moving a canister and transfer cask into the cask loading pit, lowering a canister lid into place on the canister in the cask loading pit, raising and transporting the transfer cask with a weighted canister from the loading pit to the decontamination pit, moving the loaded transfer cask into the train bay and placing it on top of the concrete storage cask located on the rail car, lowering the canister into the concrete storage cask and moving the storage cask with the weighted canister from the fuel building to the ISFSI. All demonstrations were performed safely with no significant heavy loads or rigging problems. Pre-job briefings were conducted prior to implementing the heavy load activities. The pre-job briefings were comprehensive and included good discussions concerning acceptance criteria, safe work practices, personnel responsibilities and radiological controls. During the pre-operational test, workers performed tasks as if actual canisters loaded with spent fuel were being moved. Observations were made of workers performing rigging and support for the heavy lifts. Personnel were knowledgeable and efficient in performing their work activities. The individual controlling the crane, using a radio controller, performed work safely and cautiously. The licensee's staff had implemented all the necessary elements of a satisfactory program for the control of heavy lifts. During the loading and movement of the first canister loaded with spent fuel, all heavy lift activities were observed by the NRC. The heavy lifts were conducted safely and were consistent with the operations observed during the pre-operational test. Based on readings on the crane load cell during the various lifts, the following weights were noted: empty transfer cask - 123,600 lbs (61.8 tons), empty canister - 39,800 lbs (19.9 tons), SAFLIFT device - 43,800 lbs (21.9 tons), total of SAFLIFT plus empty canister plus transfer cask - 207,200 lbs (103.6 tons).

Documents Reviewed: (a) 10 CFR 50.59 Screening S-02-0422 "Modification of the PVNGS Heavy Loads Program for the Fuel Building Cask Handling Crane," Rev 0 (b) 10 CFR 50.59 Screening

S-02-0379 "Addition of the SAFLIFT, Transfer Cask and the Shield Lid Lift Rig to the Heavy Loads Program," Rev 0 (c) NUREG-0857 Supplement 5 "PVNGS Safety Evaluation Report: Control of Heavy Loads at Nuclear Power Plants (Phase I)" (d) Letter ANPP-18281-JMA/WFQ, dated June 25, 1981 (e) 10 CFR 50.59 Screening S-02-0092 "DMWO 2436108 Cask Handling Crane Single Failure Proof Trolley Modification," Rev 1 (f) Design Specification 13-CN-0383 "Technical Requirements for Upgrading the Fuel Building Crane to Single Failure Proof," Rev 2 (g) Procedure 13-CN383-A00002-1 "150/15 Ton Single Failure Proof Cask Handling Crane - Safety Analysis Report" (h) Procedure13-CN383-A00007-0 "150/15 Ton Single Failure Proof Cask Handling Crane - Unit 2 Trolley Factory Test Procedure" (i) Procedure 13-CN383-A00008-0 "150/15 Ton Single Failure Proof Cask Handling Crane - Site Test Procedure" (j) Calculation 13-CC-ZF-0085 "Fuel Building Base Mat Design," Rev 3 (k) Procedure 13-CN383-A00184-0 "150/15 Ton Single Failure Proof Cask Handling Crane - Reconciliation of Bridge and Fuel Building Analysis for SAFLIFT and Increase in Trolley Weight" (l) Startup Work Authorization 15006 "2FH03 150/15 Ton Cask Handling Crane Certified Test Loads" (m) Startup Work Authorization 16201 "2FH03 Cask Handling Crane 125% MCL Test" (n) Preventive Maintenance Basis (PMB) #2581435 "Preventive Maintenance Basis Description" (o) Procedure 30DP-9MP11 "Field Use of Rigging," Rev 9 (p) Procedure 30DP-9MP12 "Overhead Hoisting Systems," Rev 9 (q) Procedure 30DP-9MP13 "PVNGS Rigging Control," Rev 6 (r) Procedure 01DP-0EM15 "Crane Operator Physical Exams," Rev 0 (s) Procedure 30DP-0WM17 "Crane Operator Qualification," Rev 3 (t) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (u) American Crane and Equipment Corp. Report REP-20016-002 "NUREG 0554/0612 Compliance Safety Analysis Report for Fuel Cask Cranes - Single Failure Proof Replacement Trolleys, Palo Verde Nuclear Generating Station," dated November 21, 2002

Category: Heavy Loads **Topic:** Safe Load Path

Reference: NUREG 0612, Sect 5.1.1

Requirement Safe loads paths should be defined for the movement of heavy loads to minimize the potential for heavy loads, if dropped, to impact irradiated fuel in the reactor vessel and the spent fuel pool, or to impact safe shutdown equipment.

Finding: Procedure 78OP-9ZZ02, Appendix N "Equipment Laydown and Safe Load Paths," provided a drawing of the fuel building and identified the safe load path for movement of the canister to restrict the canister from being in a position to affect the spent fuel or safe shutdown equipment. Procedure 30DP-9MP12 required safe load paths when handling heavy loads within 15 feet of the spent fuel pool. The procedure identifying the safe load path for the cask handling crane during cask loading operations allowed for a separation distance of 11 feet. This separation distance was controlled by procedures, mechanical stops, and electrical interlocks. The separation distance was acceptable since any load transported in this area would be over the cask decontamination pit or the cask loading pit. Movements of the transfer cask from the cask load pit to the concrete cask sitting on the rail car would not place the transfer cask in a position over the spent fuel pool. Procedure 30DP-9MP12 also stated that no heavy loads shall be allowed to travel over the fuel building essential air handling unit zone of influence. The zone of influence was defined as the horizontal distance from the air handling units equal to the height of the load plus one foot and in an infinite plane extending vertically. The fuel building essential air handling units were the only safe shutdown equipment that could

be affected during cask loading operations. The safe load path used for cask movement had been established in the current licensing basis for the fuel building and had been evaluated by the NRC in Section 9.4 and Appendix D of Supplement 5 to the Final Safety Analysis Report Safety Evaluation Report; NUREG-0857 dated November 1983 and found to be acceptable. The fuel building cask handling crane had been upgraded to meet the guidelines established in NUREG-0554 "Single Failure Proof Cranes for Nuclear Power Plants." This crane modification eliminated the need for a load drop analysis for the transfer cask since the single failure proof design significantly reduced the possibility of a load drop. The single failure proof design change augmented the existing heavy loads handling plan and use of a safe load path during cask loading operations.

Documents Reviewed: (a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 78OP-9ZZ01 "NAC-UMS Operations Dry Run," Rev 3 (c) Procedure 30DP-9MP12 "Overhead Hoisting Systems," Rev 9 (d) 10 CFR 50.59 Screening #S-02-0422 "Modification of the PVNGS Heavy Loads Program for the Fuel Building Cask Handling Crane," Rev 0 (e) 10 CFR 50.59 Screening #S-02-0379 "Addition of the SAFLIFT, Transfer Cask and the Shield Lid Lift Rig to the Heavy Loads Program," Rev 0 (f) NUREG-0857 Supplement 5, "PVNGS Safety Evaluation Report, Control of Heavy Loads at Nuclear Power Plants (Phase I)" (g) Letter ANPP-18281-JMA/WFQ, dated June 25, 1981 (h) 10 CFR 50.59 Screening #S-02-0092 "DMWO 2436108 Cask Handling Crane Single Failure Proof Trolley Modification," Rev 1 (i) Design Specification 13-CN-0383 "Technical Requirements for Upgrading the Fuel Building Crane to Single Failure Proof," Rev 2 (j) Procedure 13-CN383-A00002-1 "150/15 Ton Single Failure Proof Cask Handling Crane - Safety Analysis Report"

Category: Heavy Loads **Topic:** Sling Minimum Length

Reference: FSAR 1015, Sect 8.1.2.11

Requirement The top connection of the three-legged slings must be at least 75" above the top of the canister.

Finding: The Palo Verde SAFLIFT device used a grapple to raise and lower the canister inside the transfer cask. Slings were not used.

Documents Reviewed: (a) 10 CFR 72.48 Screening #S-02-009 "Dry Cask Storage Project - Impact of SAFLIFT Grapple Weight on TSC, TFR, and VCC," Rev 0 (b) 10 CFR 72.48 Screening #S-03-002 "Dry Fuel Storage Special Lifting Devices," Rev 0

Category: Heavy Loads **Topic:** Sling Safety Margins

Reference: FSAR 1015, Sect 1.2.1.5.8

Requirement All slings are commercially purchased to have adequate safety margin to meet the requirement of ANSI N14.6 and NUREG-0612.

Finding: Certificates of Test for Purchase Orders 500255983 and 500258208 provided documentation by KWIK Products for the proof testing to 2 times the safe working load for the rigging to be used for the critical lifts. This exceeded the 150% load test requirements in ANSI N 14.6. Rigging controls and inspection criteria were provided in Procedures 30DP-9MP11 and 30DP-0MP13. The rigging used in the cask loading

process was color coded and/or labeled with appropriate standards.

Documents Reviewed: (a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 78OP-9ZZ01 "NAC-UMS Operations Dry Run," Rev 3 (c) Procedure 30DP-9MP11 "Field Use of Rigging," Rev 9 (d) Procedure 30DP-0MP13 "PVNGS Rigging Control," Rev 6 (e) Certificates of Test for Purchase Orders 500255983 and 500258208 (f) ANSI N 14.6 "Special Lifting Devices for Shipping Canisters Weighing 10,000 Pounds or More"

Category: Heavy Loads **Topic:** Transfer Cask Lifting Yoke Load Test

Reference: FSAR 1015, Sect 1.2.1.5.8

Requirement The transfer cask lifting yoke is initially load tested to 300% of the maximum service load.

Finding: Independent testing of the transfer cask lifting device was performed using weights exceeding the 300% criteria. The licensee was using a system with a below-the-hook lifting device called a SAFLIFT. This single failure proof handling system will be used in place of a transfer cask lifting yoke. A 125-ton rated "lift beam" was the special lifting device designed and fabricated in accordance with ANSI N14.6 to be used to engage and lift the transfer cask. During cask loading operations, the maximum lift beam load weight was anticipated to be approximately 209,319 pounds according to the NAC-UMS Final Safety Analysis Report, Section 3.2, Table 3.2-3, "Calculated Under-Hook Weights." This would be the weight of a loaded canister filled with water inside the transfer cask with the shield lid in place. This weight estimate included 5,816 lbs for a lifting yoke, which will not be used by Palo Verde. Fritz Testing Laboratory conducted the offsite load test of the SAFLIFT with the crane manufacturer, ASECO, and licensee personnel observing. The test was conducted on September 5, 2002 with an equivalent test load weight of 790,000 pounds. The 790,000 pound test weight exceeded 300% of the anticipated load which would be experienced during cask movement activities.

Documents Reviewed: (a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) NAC-UMS Final Safety Analysis Report, Rev 2 (c) Procedure 13-CN383A-A00077-0 "Dry Cask Storage Project - SAFLIFT Factory Test Procedure" (d) Procedure 13-CN383A-A00019-0 "Dry Cask Storage Project - SAFLIFT Site Test Procedure" (e) ANSI N 14.6 "Special Lifting Devices for Shipping Canisters Weighing 10,000 Pounds or More"

Category: Heavy Loads **Topic:** Transfer Cask Trunnion Annual Inspection

Reference: FSAR 1015, Sect 9.2.2

Requirement Annually the lifting trunnions, shield door and shield door rails shall be either dye penetrant or mag particle examined in accordance with ASME Section V. Acceptance criteria shall be in accordance with Section III, Subsection NF, Article NF-5350 or NF-5340. The annual examination may be delayed for periods of nonuse, provided the exam is performed prior to next use of the cask. Also, the coating applied to any carbon steel surfaces of the transfer cask shall be inspected annually and any chips, cracks or other defects in the coating repaired.

Finding: Procedure PMB #2581435 incorporated the required annual examinations of the lifting

trunnions, shield door and shield door rails. Work Orders #2581525 and #2581450 included acceptable guidance for performing the required examinations.

Documents Reviewed: (a) Preventive Maintenance Basis Procedure PMB # 2581435, "Preventive Maintenance Basis Description" (b) Work Order #2581525 (c) Work Order #2581450 (d) Routine Task Information Database - Activities 112565 and 112557.

Category: Heavy Loads **Topic:** Transfer Cask Trunnion Tests

Reference: FSAR 1015, Sect 9.1.2

Requirement The transfer cask lifting trunnions and the bottom shield doors shall be tested in accordance with the requirements of ANSI N14.6, "Special Lifting Devices". The trunnion load test shall apply a vertical load of 660,000 lbs. The bottom shield door test shall apply a vertical load of 266,000 lbs. Load tests shall be held for a minimum of 10 min. Load bearing surfaces shall be visually examined and mag particle or liquid penetrant tested per ASME Code Section V Articles 1,6,and/or 7. Acceptance criteria is ASME Code Section III, NF-5340 or NF-5350.

Finding: Hi Tech Manufacturing successfully conducted the offsite load tests of the transfer cask lifting trunnions and the bottom shield doors to comply with the requirements of ANSI N14.6. Following the load test, non-destructive examinations were completed for the components. The test was conducted on June 5, 2002. The primary and secondary trunnions were load tested to 709,170 pounds which exceeded the required 660,000 pounds. The bottom shield doors were load tested to 307,000 pounds which exceeds the required 266,000 pounds. All of the load tests applied the load for a minimum of 10 minutes.

Documents Reviewed: Manufacturing Procedure/Specification 01013-LT, "Load Test Procedure," Rev 1

Category: Hydro/Drying/Helium **Topic:** Helium Backfill Pressure

Reference: CoC 1015, Tech Spec A.3.1.3

Requirement The canister helium backfill pressure shall be 0 (+1,-0) psig

Finding: The licensee had incorporated the requirements for the helium backfill limits from the technical specifications into the loading procedure. Procedure 78OP-9ZZ02, Step 7.8.5 specified the acceptance criteria as 0.1 to 0.9 psig. The acceptance criteria accounted for the 0.1 psig error associated with the pressure gauge. Step 7.8.4 recorded the current atmospheric pressure. Step 7.8.5.1 calculated the upper and lower bands of acceptance for the cask pressure by adding the 0.1 and 0.9 psig respectively to the current atmospheric pressure and recording the values as the acceptance criteria for the backfill pressure. For the first cask loaded with spent fuel, the atmospheric pressure was recorded as 14.13 psig. This would make the bounds for acceptable helium backfill pressure to be 14.23 psi to15.03 psi. The actual helium backfill pressure was recorded in Step 7.8.10 as 14.48 psi on March 11, 2003. This met the required technical specification limits. The Heise pressure gauge used for measuring the helium backfill pressure had been calibrated prior to use and was sent back to the calibration lab to verify the calibration after the helium backfill activity had been completed.

Documents Reviewed: Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category:	Hydro/Drying/Helium **Topic:** Helium Leak Rate Test
Reference:	CoC 1015, Tech Spec A.3.1.5
Requirement	There shall be no indication of a helium leak at a sensitivity of 1.0 X 10(-7) cubic cm/sec through the canister shield lid to canister shell confinement weld to demonstrate a helium leak rate equal to or less than 2.0 X 10(-7) cubic cm/sec.
Finding:	Procedure 78OP-9ZZ02, Section 7.9 incorporated the shield lid leak testing requirements including the leak limits specified in Technical Specification A.3.1.5.. Step 7.9.8 stated "Perform the shield lid leak test in accordance with the ASME Code Section V, Article 10 and ANSI N14.5 "Radioactive Materials - Leakage Tests on Packages for Shipment" for the evacuated envelop test method." Step 7.9.8.8 stated "Operate the helium leak detector to verify that there is no indication of a helium leak exceeding 2E-7 cubic cm/sec (helium) at a minimum test sensitivity of 1E-7 cubic cm/sec (helium).
Documents Reviewed:	Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category:	Hydro/Drying/Helium **Topic:** Helium Leak Test Personnel
Reference:	FSAR 1015, Sect 7.1.3.3.6
Requirement	All personnel performing helium leak test examinations shall be qualified in accordance with the NAC quality assurance program and the American Society for Nondestructive Testing, Inc. Recommended Practice No. SNT-TC-1A "Personnel Qualification and Certification in Nondestructive Testing." Note: This requirement is also specified in FSAR Table 1.2-3.
Finding:	Welding Services Inc. had developed a certification program in accordance with SNT-TC-1A guidelines in WSI Procedure QAP 2.7 and had certified two helium leak detection personnel. The PVNGS In-Service Inspection Engineering Certification Review Summary Sheet documented the evaluation of the qualifications of the two contractor personnel that would be performing the helium leak testing of the lid to shell and vent and drain port cover welds. Welding Services Inc. "Certificate of Qualification" for both personnel documented that they were qualified under the requirements specified in WSI Procedure QAP 2.7.
Documents Reviewed:	(a) PVNGS "In-Service Inspection Engineering Certification Review Summary Sheet," dated February 4, 2003 (b) Welding Services, Inc. "Certificate of Qualification" (c) WSI Procedure QAP 2.7 "Selection, Training, Qualification and Certification of Non-Destructive Testing Personnel," Rev 7

Category:	Hydro/Drying/Helium **Topic:** Helium Purity - Controls for Use
Reference:	FSAR 1015, Sect 8.1.1.32
Requirement	Backfill the canister with helium having a minimum purity of 99.9%.
Finding:	The work orders and the acquisition part number for ordering the helium was reviewed for the purchase of the helium gas used in the first canister loading and planned for the next two loadings. The documentation confirmed that 99.9% helium was purchased. The helium was being stored separately in the chemical warehouse until needed. Verification of the use of helium for backfilling was made when the helium was connected to the vacuum drying skid in Step 7.8.1.2 of Procedure 780P-9ZZ02. The

proper valve alignment of the helium gas was verified through the use of two party verification with sign-off in the procedure. The helium gas lines were tagged and color coded and the helium gas line fittings were unique for the helium bottles. During the first cask loading, the NRC inspectors verified that the helium gas used for the backfilling was 99.9% pure. However, the 99.9% helium tanks were not labeled as such. Verification was done through comparison of the lot number on the tanks with the lot number on the certificate of conformance for the 99.9% pure helium.

Documents Reviewed: (a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Work Order WO #2521384 "Perform Dry Cask Loading of TSC #1" (c) Work Order WO #25263364 "Perform Dry Cask Loading of TSC #2" (d) Work Order WO #2563369 "Perform Dry Cask Loading of TSC #3" (e) Acquisition Part Number (APN) Item No 00072488 "Helium Gas for Dry Cask"

Category: Hydro/Drying/Helium **Topic:** Helium Purity - Procurement Controls

Reference: FSAR 1015, Sect 8.1.1.32

Requirement Backfill the canister with helium having a minimum purity of 99.9%.

Finding: Purchase Order #500259123 for the helium to be use in the canisters specified 99.9% pure helium. The certificate of conformance and the quality receiving checklist associated with the purchase order also specified 99.9% helium purity.

Documents Reviewed: (a) PVNGS Purchase Order #500259123 (b) PO 500259123 "Quality Receiving Checklist for Helium Gas used for Dry Cask Storage" (c) PO 500259123 "Certificate of Conformance for Helium Supplied by Airgas Specialty Gases" (d) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category: Hydro/Drying/Helium **Topic:** Pressure Test on Canister

Reference: FSAR 1015, Sect 9.1.2 & 7.1.3.3.10

Requirement With approximately 50 gallons of water removed, the canister is pressure tested to 35 psia and held for 10 minutes. Any loss of pressure during the test period is unacceptable and the leak must be repaired. Per Section 7.1.3.3.10 of the FSAR, this test is to be performed in accordance with ASME Code NB-6321.

Finding: Procedure 78OP-9ZZ02, Section 7.5 incorporated the requirement for the shield lid weld pressure test. Step 7.5.15 of the procedure specified a test pressure of 35.5 psia. Step 7.5.18 specified the 10 minutes as the required time for the test. Step 7.5.18 provided a table to be completed documenting the test time and pressure. For the first canister loaded, the pressure test was conducted on March 7, 2003. The pressure was maintained at 35.77 psia for the required 10 minutes.

Documents Reviewed: Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category: Hydro/Drying/Helium **Topic:** Returning Canister to Spent Fuel Pool

Reference: CoC 1015, Tech Spec A.3.1.1

Requirement If the time limit for drying the canister cannot be achieved, the cask must be returned to the spent fuel pool per Technical Specification A.3.1.1, Action A.2.1 within 2 hours and

cooled for at least 24 hours "OR" per Action A.3.1, supplied air can be connected to the canister annulus with a flow rate of 375 CFM and temperature of 75 degrees F for 24 hours.

Finding: Procedure 78OP-9ZZ02, Step 7.6.46 calculated the time allowed for completion of vacuum drying based on the values listed in Technical Specification A.3.1.1. The caution after Step 7.6.46.6 stated that if the time limit for drying was not met, take actions per Appendix J "Off-Normal and Accident Contingency Actions," Step 2.5 "Canister In-Pool Cooling Operation." Appendix J specified in-pool cooling for a minimum of 24 hours.

Documents Reviewed: (a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category: Hydro/Drying/Helium **Topic:** Time Limit after Helium Backfill

Reference: CoC 1015, Tech Spec A.3.1.4

Requirement For canisters with a heat load greater than 14 kW, there is a limit for how long the canister can be in the transfer cask from the time of completion of helium backfill to the time the canister is inserted into the storage cask. This limit is based on the canisters kW heat load.

Finding: The licensee did not plan to load any casks above 14 kW. This was specified in Procedure 780P-9ZZ02, Step 3.17 of the Limitations and Precautions section of the procedure and in the Note in Step 7.8.10. The 14 kW limitation was due to Palo Verde not having a forced air cooling system to cool the canisters if the specified time limit was exceeded. Casks with heat loads below 14 kW do not have a limit for the time the canister can be in the transfer cask. In addition, Procedure 72DP-9NF02, Section 3.4.3, which was used for the selection of the spent fuel, limited the spent fuel selected for storage to 14 kW.

Documents Reviewed: (a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 72DP-9NF02 "Fuel Assembly Selection for Dry Cask Storage," Rev 3

Category: Hydro/Drying/Helium **Topic:** Time Limit for Vacuum Drying

Reference: CoC 1015, Tech Spec A.3.1.1

Requirement The technical specifications provide various time limits for vacuum drying based on the kW of the cask. Exceeding the time limit requires the licensee to initiate actions to cool the fuel within a certain time frame.

Finding: Procedure 78OP-9ZZ02 incorporated the technical specification requirements for the vacuum drying time limits into Section 7.6.46 of the procedure. The time limits from Technical Specification A.3.1.1 were stated in a table in Step 7.6.46.2 of the procedure for casks with heat loads up to 14 kW. The procedure provided a blank space for entering a value for the date and time when vacuum drying must be completed to comply with the technical specification and included a second party verification requirement to confirm that the correct date/time had been determined. A caution was included in the procedure that directed the user to Appendix J "Off-Normal and Accident Contingency Actions" Step 2.5 "Canister In-Pool Cooling Operations" if the canister drying time could not be achieved.

Documents Reviewed:	Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category:	Hydro/Drying/Helium **Topic:** Vacuum Drying Pressure
Reference:	CoC 1015, Tech Spec A.3.1.2
Requirement	The canister vacuum drying pressure shall be less than or equal to 3 mm (torr) of mercury. Pressure shall be held for not less than 30 minutes
Finding:	The licensee had incorporated the vacuum drying pressure requirements from the technical specification into the loading procedure, including consideration of the error for the instrumentation being used. Procedure 78OP-9ZZ02, Step 7.7.7.28 provided a table to record the vacuum drying pressure achieved and to compare it to the acceptance criteria of 2.6 torr. The licensee had established 2.6 torr as the upper limit for the acceptance test to account for instrument error in achieving the 3.0 torr limit. In the prerequisite section of the procedure, Step 4.14, the calibration due date for the pressure gauge was required to be confirmed to verify that the gauge was in calibration prior to beginning cask loading. Calibration records for the modular vacuum gauge and associated transponder planned for use on the first canister were reviewed to confirm the calibration was current. During the loading of the first canister, the vacuum drying pressure achieved on March 11, 2003 was 1.73 torr for 30 minutes.
Documents Reviewed:	(a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Calibration Record for Televec MM200 Modular Vacuum Gauge and associated Transponder, Serial Number #020435, dated January 17, 2003

Category:	Pre-Operational Tests **Topic:** Pre-Operational Testing and Training Exercise
Reference:	CoC 1015, Tech Spec A.5.2
Requirement	A dry run training exercise on loading, closure, handling, unloading, and transfer of a NAC-UMS Storage System shall be conducted by the licensee prior to the first use of the system to load spent fuel assemblies. Technical Specification A.5.2 provides a list of 14 demonstrations that must be performed.
Finding:	Palo Verde conducted all required pre-operational testing and training exercises specified by Technical Specification A.5.2. The NRC observed the required demonstrations during 4 inspection trips to the site. Inspection support was also provided by the NRC Resident Inspectors when the regional inspectors were not onsite. The demonstrations included: placing the transfer cask containing a canister into the cask loading pit, loading dummy spent fuel assemblies into the canister, installing the shield lid underwater, lifting the transfer cask out of the cask loading pit, transferring the canister to the concrete cask, installing the concrete cask shield plug and lid and moving the concrete cask from the fuel building to the ISFSI pad. On a truncated canister, the licensee demonstrated welding a lid, performing weld inspections, pressure testing the canister, vacuum drying and leak testing. The licensee also demonstrated the process for moving a loaded canister from the ISFSI pad into the cask loading pit, testing the internal atmosphere and removing the spent fuel. Cutting the welded lid off a canister was not demonstrated. Palo Verde planned to use the same cutting tool and cutting process used at Maine Yankee which had been inspected by NRC Region 1 and documented in NRC Inspection Report 05000309/2002002. Maine Yankee was using a NAC-UMS cask

system under the same Certificate of Compliance #1015 as was being used at Palo Verde. A review of the Maine Yankee inspection report determined that the process would be equally successful at Palo Verde for removing a lid from a NAC-UMS canister. The licensee conducted their first NRC observed pre-operational test on November 13-14, 2002 to demonstrate welding of a lid onto a truncated canister. Several deficiencies related to welder qualifications, procedure approvals, welding hold points, tack welding requirements, liquid penetrant examinations, foreign material control and material procurement control were observed during the welding demonstration. Palo Verde repeated the demonstration on February 4-5, 2003. The licensee had implemented an effective corrective action process that resulted in a second welding demonstration that produced a high quality weld and corrected all problems identified during the first demonstration. Overall, the licensee conducted a thorough pre-operational test program which demonstrated that the workers were knowledgeable of the design requirements for use of the NAC-UMS cask system and were proficient in the procedures for loading and unloading a cask at the Palo Verde Nuclear Station.

Documents Reviewed: (a) Palo Verde Schedule for Dry Run (b) NRC Inspection Report 05000309/2002002 for the Maine Yankee Atomic Power Company, dated September 19, 2002.

Category: Procedures & Tech Specs **Topic:** Annual Cask Inspections

Reference: FSAR 1015, Sect 9.2.1

Requirement An annual inspection of the concrete cask is required to include visual inspection of concrete surfaces for chipping, spalling or other surface defects. Defects larger than 1" in diameter and deeper than 1" shall be regrouted and concrete-inhibiting (external) coatings re-applied on accessible corroded surfaces, including concrete cask lifting lugs, if present.

Finding: The requirement for annual inspection of the concrete casks was incorporated into Procedure 81DP-0ZZ01, page 10. The Regulatory Commitment Tracking System (RCTS) was used to track work activities due and included the annual cask inspection requirement. In addition to the annual inspection of the concrete cask, Procedure 78OP-9ZZ02, Appendix A required a pre-use inspection of the concrete to verify that no cracking or spalling in excess of the 1" requirements were present. If present, repair and regrouting was required.

Documents Reviewed: (a) Procedure 81DP-0ZZ01 "Civil System, Structure, and Component Monitoring Program," Rev 8 (b) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (c) Procedure 51DP-9OM03 "Site Scheduling," Rev 10 (c) Current printout of Regulatory Commitment Tracking System (RCTS)

Category: Procedures & Tech Specs **Topic:** Cask Drop or Tipover

Reference: CoC 1015, Tech Spec A.5.4

Requirement The concrete cask and canister shall be inspected if the cask experiences a drop or a tipover.

Finding: Procedure 780P-9ZZ02 for loading a cask and Procedure 780P-9ZZ03 for unloading a cask included the requirement to perform a cask inspection for any cask drop accident over 24 inches. The 24 inch criteria was consistent with Table A.5-1 of the Certificate

of Compliance. Procedure 780P-9ZZ02 , Appendix J "Off-Normal and Accident Contingency Actions," Step 1.6 specified that an inspection of the cask was required in accordance with Technical Specification A.5.4.

Documents Reviewed: (a) Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 780P-9ZZ03 "NAC-UMS Cask Unloading Operations," Rev 1

Category: Procedures & Tech Specs **Topic:** Cask Heat CharacteristicsTest (First 10 kW Cask)

Reference: CoC 1015, Tech Spec A.5.3

Requirement The heat transfer characteristics and performance of the NAC-UMS system will be recorded by air inlet and outlet temperature measurements of the first system placed in service with a heat load greater than 10 kW. A letter report summarizing the results of the measurements will be submitted to the NRC within 30 days of the cask being placed on the ISFSI pad. The report will include a comparison of the calculated temperatures of the heat load to the measured temperatures.

Finding: Procedure 780P-9ZZ02, Appendix M included the requirement to conduct the heat transfer characteristics test and to submit a letter report summarizing the results of the measurements for the first system placed in service with a heat load greater than or equal to 10 kW to the NRC within 30 days of the cask being placed on the ISFSI pad. Palo Verde plans to load cask #3 with 10.17 kW and will perform the required test.

Documents Reviewed: Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category: Procedures & Tech Specs **Topic:** Drop Limit

Reference: CoC 1015, Tech Spec A.5.6

Requirement The lifting height above the transport surface shall not exceed the limits in Table A 5-1. The value in Table A 5-1 is 24 inches

Finding: Both Procedure 780P-9ZZ02 for cask loading and Procedure 780P-9ZZ03 for cask unloading have statements in the Precautions and Limitations section that limit the maximum allowable cask lift height to 24 inches during surface transport. Both procedures also have individual steps, with required verification signature, requiring the cask transporter lifting device limit switches to be operational and set to limit the lift height to less than or equal to 24 inches.

Documents Reviewed: (a) Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 780P-9ZZ03 "NAC-UMS Cask Unloading Operations," Rev 1

Category: Procedures & Tech Specs **Topic:** Procedures for Loading and Closing Canister

Reference: FSAR 1015, Sect 8.1.1

Requirement Section 8.1.1 provides the sequence of events for loading and closing a canister.

Finding: The licensee had incorporated the procedural requirements listed in the FSAR, Section 8.1.1 into Sections 4.0, 5.0, 6.0 and 7.0 of Procedure 78OP-9ZZ02 for loading and closing a canister. FSAR Section 8.1.1 identified specific requirements and cautions associated with the pre-use visual inspection of the canister, placement of the empty canister into the transfer cask, loading the canister with spent fuel, hydrogen monitoring

during welding, welding and non-destructive examination of the lid welds, helium backfill requirements, torque values and time limitations for specific critical tasks. During the loading of the first canister, the licensee observed that the 10th fuel assembly had not fully seated into the canister and was approximately 2" above its expected position. Using the underwater camera, the licensee examined the other fuel assemblies and determined that a second fuel assembly appeared to be approximately 1" too high. Work was stopped and condition report/disposition request CRDR #2589695 was issued. This same problem had been encountered at another reactor site using the NAC-UMS canister. The problem was due to the bottom plate in the canister having a slightly smaller opening than the insertion sleeve requiring the assembly to be centered when it reached the bottom plate, otherwise the assembly could catch on the edge of the bottom plate. The two assemblies were raised slightly, repositioned and successfully re-inserted. The time required to load the first cask with 24 spent fuel assemblies was 8 hours. This included a 3 hour delay to resolve the issue with the two assemblies.

Documents Reviewed: (a) Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) CRDR #2589695 "During Canister Loading, Fuel Assemblies Placed into TSC Locations 9 and 19 were not fully seated in the Canister," dated March 12, 2003

Category: Procedures & Tech Specs **Topic:** Procedures for Loading Storage Cask

Reference: FSAR 1015, Sect 8.1.2

Requirement Section 8.1.2 provides the sequence of events for loading the storage cask.

Finding: The licensee had incorporated the procedural requirements listed in the FSAR, Section 8.1.2 into Section 8.0 of Procedure 78OP-9ZZ02 for loading a canister into the concrete storage cask. FSAR Section 8.1.2 identified specific requirements and cautions associated with the lifting of the canister, raising the canister and moving it over the concrete cask, opening the transfer cask shield doors, lowering the canister into the concrete cask, installing the shield plug and concrete cask lid and installing the tamper-indicating seal.

Documents Reviewed: Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category: Procedures & Tech Specs **Topic:** Procedures for Removing a Canister from a Cask

Reference: FSAR 1015, Sect 8.2

Requirement Section 8.2 provides the sequence of events for removing a loaded canister from a storage cask for transport offsite or because of an off-normal event.

Finding: The licensee had incorporated the procedural requirements listed in the FSAR, Section 8.2 into Section 5.0 of Procedure 78OP-9ZZ03 for unloading a canister from a concrete storage cask. FSAR Section 8.2 identified specific requirements and cautions associated with opening the concrete cask, removing the canister from the concrete cask and operating the shield doors on the transfer cask. Procedure 78OP-9ZZ03 included good detail information for returning a cask to the fuel building including specific appendices for inspecting the concrete cask prior to movement, limiting flammable liquids near the transportation route and identifying the acceptable rail spurs for use.

Documents Reviewed: Procedure 780P-9ZZ03 "NAC-UMS Cask Unloading Operations," Rev 1

Category:	Procedures & Tech Specs **Topic:** Procedures for Transport & Placement of a Cask
Reference:	FSAR 1015, Sect 8.1.3
Requirement	Section 8.1.3 provides the sequence of events for transporting and placing a storage cask onto the ISFSI pad.
Finding:	The licensee had incorporated the procedural requirements listed in the FSAR, Section 8.1.3 into Section 8.11 of Procedure 78OP-9ZZ02 for transporting and placing a storage cask onto the ISFSI pad. FSAR Section 8.1.3 identified specific requirements associated with lifting height limits, spacing requirements between casks and installation of the temperature monitoring system. The FSAR assumed that an air pad system was used for part of the moving activities to the pad. Palo Verde was not using an air pad system and had not incorporated this information into their procedure.
Documents Reviewed:	Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category:	Procedures & Tech Specs **Topic:** Procedures for Unloading a Canister
Reference:	FSAR 1015, Sect 8.3
Requirement	Section 8.3 provides the sequence of events for removing spent fuel from a loaded canister.
Finding:	The licensee had incorporated the procedural requirements listed in the FSAR, Section 8.3 into Sections 5.0 of Procedure 78OP-9ZZ03 for opening and unloading the spent fuel from a canister. FSAR Section 8.3 identified specific requirements and cautions associated with conducting radiological surveys, sampling the canister atmosphere, verifying that hydrogen was not present prior to cutting open the canister, refilling the canister with water, cutting the lid off and removing the spent fuel.
Documents Reviewed:	Procedure 780P-9ZZ03 "NAC-UMS Cask Unloading Operations," Rev 1

Category:	Procedures & Tech Specs **Topic:** Spacing of Casks on ISFSI Pad
Reference:	FSAR 1015, Sect 8.1.3.5
Requirement	Spacing between concrete casks must no be less than 15 feet center-to-center.
Finding:	Procedure 78OP-9ZZ02, Step 8.11.13 required an edge-to-edge spacing of greater than or equal to 3' 10" between the canisters. Based on the diameter of the concrete cask being 136" from Table 1.2-2 of the FSAR, the minimum distance center-to-center for the casks with a 3' 10" spacing would be 15' 2". This exceeds the 15 foot minimum spacing requirement.
Documents Reviewed:	(a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category:	Procedures & Tech Specs **Topic:** Surveillances After Off-Normal Events
Reference:	CoC 1015, Tech Spec A.5.4 & FSAR Sect 9.2.1
Requirement	A response surveillance is required following off-normal, accident, or natural phenomena events. The NAC-UMS system in use at an ISFSI shall be inspected within 4 hrs after occurrence of the event in the area of the ISFSI. This inspection must verify that all the concrete cask inlets and outlets are not blocked or obstructed. At least half of

the inlets and outlets on each cask must be cleared within 24 hrs to restore air circulation.

Finding: The licensee had incorporated a requirement for a visual inspection of the concrete casks at the ISFSI within four hours of any off-normal, accident, or natural phenomena event in Procedures 78OP-9ZZ02, Appendix J and Procedure 40AO-9ZZ21, Appendix E. The appendices to the two procedures also included the 24 hour requirement to clear at least half of the inlets and outlets on each cask within 24 hrs to restore air circulation. Events requiring the cask inspection within four hours included natural phenomena such as severe weather conditions, tornado strikes, blackouts and seismic events. Off-normal or accident events that required the inspection within four hours included, but were not limited to, explosions, fires, lightning strikes, loss of power and tipover of cask.

Documents Reviewed: (a) Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 780P-9ZZ03 "NAC-UMS Cask Unloading Operations," Rev 1 (c) Procedure 78ST-1XD01 "Daily ISFSI Temperature Monitoring Surveillance," Rev 0 (d) Procedure 40AO-9ZZ21 "Acts of Nature," Rev 19

Category: Procedures & Tech Specs **Topic:** Temperature Minimum Limits for Storage Cask

Reference: CoC 1015, Tech Spec B.3.4.1.9

Requirement The storage cask shall only be lifted by the lifting lugs with surrounding air temperatures greater than or equal to 0 degrees F.

Finding: Procedure 78OP-9ZZ02, Step 3.16 stated that in the unlikely event that 0 degrees F temperatures occurred, transfer cask operations and lifting the vertical concrete cask by the lifting lugs were not allowed. Procedure 78OP-9ZZ03 for unloading a cask also had the same limitation specified. The ISFSI 72.212 Evaluation Report, Section 2.4.2.4.8 stated that based on National Weather Service data from the Sky Harbor International Airport in Phoenix, Arizona, there had never been a below zero reading recorded in Phoenix.

Documents Reviewed: (a) Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 78OP-9ZZ03 "NAC-UMS Cask Unloading Operations," Rev 1 (c) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0

Category: Procedures & Tech Specs **Topic:** Temperature Minimum Limits for Transfer Cask

Reference: CoC 1015, Tech Spec B.3.4.1.8

Requirement Transfer cask operations shall only be conducted with surrounding air temperatures greater than or equal to 0 degrees F.

Finding: Procedure 78OP-9ZZ02, Step 3.16 stated that in the unlikely event that 0 degrees F temperatures occurred, transfer cask operations and lifting the vertical concrete cask by the lifting lugs were not allowed. Procedure 78OP-9ZZ03 for unloading a cask also had the same limitation specified.

Documents Reviewed: (a) Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 78OP-9ZZ03 "NAC-UMS Cask Unloading Operations," Rev 1

Category: Procedures & Tech Specs **Topic:** Temperature Monitoring of Cask

Reference: CoC 1015, Tech Spec A.3.1.6

Requirement On a 24 hr basis, verify that the difference between the average storage cask air outlet temperature and ISFSI ambient temperature is less than or equal to 102 degrees F (PWR).

Finding: The licensee incorporated the requirement to verify the operability of the heat removal system during storage operations in Procedure 78ST-1ZD01. The procedure stipulated that the temperature monitoring system was to be tested for operability at a frequency of less than or equal to 24 hours. The licensee had established a remote station in the Unit 1 computer room to monitor the temperature of the casks stored at the ISFSI. The acceptance criterion in the procedure stipulated that the difference between the average concrete cask air outlet temperature and the ISFSI pad ambient temperature for each cask was limited to less than or equal to 90 degrees Fahrenheit. This is more conservative than the required 102 degree technical specification limit. If the criterion was not met, the operator was to notify the control room supervisor, declare the affected canister inoperable and enter Technical Specification Limiting Conditions for Operations (LCO) A.3.1.6. In the event that the system was inoperable, the procedure directed the operator to perform an inspection of the affected cask's vents.

Documents Reviewed: Procedure 78ST-1ZD01 "Daily ISFSI Temperature Monitoring Surveillance," Rev 0

Category: Procedures & Tech Specs **Topic:** Time to Boil Limit

Reference: FSAR 1015, Sect 8.1.1.12

Requirement Note the time the transfer cask is removed from the pool. Operations through Step 28 (drain the canister) must be completed in accordance with Table 8.1.1-3 "Handling Time Limits Based on Decay Heat Load with a Canister Full of Water."

Finding: Procedure 78OP-9ZZ02 included a requirement to record the time that the shield lid was installed in the cask loading pit and to compute the time remaining to complete the canister draining cycle before the time to boil limit would be reached. The data was recorded in Appendix P, "Canister Drain Cycle Time Limits." The appendix contained a table of values for time limits to complete draining based on the canister's analyzed heat load. If the time limit for the canister draining cycle was exceeded, the procedure provided for actions in Appendix G "Ashland VDS Setup, Operation, and Removal" to perform circulation cooling.

Documents Reviewed: Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category: Procedures & Tech Specs **Topic:** Torque Values

Reference: FSAR 1015, Table 8.1.1-2

Requirement Table 8.1.1-2 provides torque values for the transfer cask and canister.

Finding: Procedure 78OP-9ZZ02, Appendix D "Torque Values" provided a listing of the required torque values for various components. The torque values were also incorporated into applicable procedural steps. The torque values in Revision 1 of the procedure were consistent with the values in the FSAR, Table 8.1.1-2 "Torque Values." In Revision 3 of the procedure, the torque value had been increased from 125 +/- 5 ft-lbs to 135 +/- 15 ft-lbs for the canister drain tube in Step 7.2.38. During the first canister loading,

problems had occurred with leaks around the metal seals of the vent and drain ports for the canister drain tube and a slightly higher torque value was being used. In Revision 5 of the procedure, Appendix D had been deleted and the seals for the canister drain tube had been changed from metal seals to a Viton seal. Step 7.2.40 specified the use of the Viton seal on the canister drain tube and Step 7.4.21 directed the canister drain tube to be tightened snug plus one flat. No torque value was specified. These changes to the procedure for the torque values for the metal seals and the use of the Viton seal had been evaluated by NAC in their 10 CFR 72.48 Determination Checklist ID #NAC 02-UMS-168 and found to be acceptable modifications for the canister vent and drain seals.

Documents Reviewed: (a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3, and Rev 5 (b) NAC-UMS Final Safety Analysis Report, Rev 2 (c) NAC 10 CFR 72.48 Determination Checklist ID #NAC 02-UMS-168, dated December 4, 2002

Category: Procedures & Tech Specs **Topic:** Transfer Cask Trunnion Inspection Prior To Use

Reference: FSAR 1015, Sect 9.2.2

Requirement The transfer cask trunnions and shield door assemblies shall be visually inspected for gross damage and proper function prior to each use.

Finding: Procedure 78OP-9ZZ02, Appendix C "TFR Pre-Use Inspections" established the required inspections to be performed including the visual inspections of the trunnions and the transfer doors (shield doors) prior to each use.

Documents Reviewed: Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category: Procedures & Tech Specs **Topic:** Visual Inspection of Canister Prior to Use

Reference: FSAR 1015, Sect 8.1.1.1

Requirement Visually inspect the basket fuel tubes to ensure that they are unobstructed and free of debris. Ensure that the welding zone on the canister, shield, and structural lid and port covers are prepared for welding. Ensure transfer cask door lock bolts/lock pins are installed and secure.

Finding: The licensee had incorporated pre-use inspection instructions for the concrete cask, transfer cask (TFR) and canister (TSC) into Procedure 78OP-9ZZ02, Appendix A "Concrete Cask Pre-Use Inspections," Appendix B "TSC Pre-Use Inspections" and Appendix C "TFR Pre-Use Inspections." The three appendices included detail inspection guidance and were formatted as checklists for documenting completion of the pre-use inspections. Appendix B specifically required inspection of the canister fuel tube openings for debris and general condition. Appendix B also required inspection of the canister shield lid, structural lid and port covers for dents, gouges and other shipping damage. Appendix C required the transfer cask door pin restraints to be installed and secure. Document 407-S-21, Section 9.2.3.1 required that surfaces to be welded shall be clean and free of slag, scale, rust, oil, grease and other deleterious materials for a distance of at least 1-inch from the weld joint.

Documents Reviewed: (a) Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Document 407-S-21 "Fabrication Specifications for Field Closure Welding of the NAC-UMS Transportable Storage Canister at APS Palo Verde Nuclear Generating Station," Rev 0

Category:	Procedures & Tech Specs	**Topic:**	Written Procedures Required
Reference:	10 CFR 72.212(b)(9)		
Requirement	The licensee shall conduct activities related to storage of spent fuel under this general license only in accordance with written procedures.		
Finding:	The licensee had developed an extensive number of procedures for use with the dry cask storage project and had revised a number of existing site procedures to incorporate ISFSI activities. Procedures reviewed during this inspection were found to provide good guidance for activities consistent with requirements identified in the FSAR, the Certificate of Compliance #1015 and the NAC-UMS Technical Specifications. Procedures covered all the topics related to ISFSI activities including security, radiological programs, quality assurance, welding, engineering, emergency planning, fire protection, training, regulatory affairs, maintenance, operations, fuel management and procurement. Procedures included precautions, prerequisites and supporting information as appropriate. Procedures related to operational activities used action oriented steps with space for checking off the activity after completion. Key activities related to technical specification compliance had exerts from the technical specifications stating the requirement and provided spaces for entering the necessary data to demonstrate compliance.		
Documents Reviewed:	Listing provided by Palo Verde of Procedures/Manuals Used in Support of Dry Cask Storage Activities		

Category:	QA	**Topic:**	Approved QA Program
Reference:	10 CFR 72.140(d)		
Requirement	A QA program previously approved by the Commission as satisfying the requirements of Appendix B to Part 50 will be accepted as satisfying the requirements of Part 72. In filing the description of the QA program required by Part 72.140(c), each licensee shall notify the NRC of it's intent to apply it's previously approved QA program to ISFSI activities. The notification shall identify the previously approved QA program by date of submittal, docket number and date of Commission approval.		
Finding:	Palo Verde notified the NRC by letter dated March 15, 2000 of their plans to apply the NRC-approved Part 50 Appendix B reactor facility quality assurance program to the ISFSI. On October 5, 2001, Palo Verde provided the NRC with a table comparing the applicable sections of 10 CFR 72 Subpart G "Quality Assurance" with the Palo Verde Part 50 quality assurance program. This comparison included 10 CFR 72.142 through 72.176 of Subpart G. All sections of the existing Part 50 quality assurance program were fully compatible with Subpart G, except for 10 CFR 72.144 "Quality Assurance Program" and 10 CFR 72.174 "Quality Assurance Records." For the quality assurance program section, information was needed concerning identification of the ISFSI structures, systems and components (SSC's) that would be covered by the quality assurance program. The licensee performed Engineering Study A0-CS-A018 to determine which SSC's were "important to safety" and classified those SSC's into three categories according to their 10 CFR Part 72 safety significance. The engineering study also established the seismic classification of the SSC's. A graded approach was used to assign the appropriate quality criteria to the ISFSI SSC's. Quality classifications for the graded approach were defined consistent with NUREG/CR-6407 "Classification of		

Transportation Packaging and Dry Cask Storage Components According to Importance to Safety," dated February 1996. For the Part 50 quality assurance program section that was not fully compatible with 10 CFR 72.174 quality assurance records, Palo Verde obtained an exemption by letter dated September 27, 2002 which allowed Palo Verde to maintain a single set of spent fuel records in accordance with 10 CFR 50.71(d)(1) instead of the duplicate set of records required by 10 CFR 72.72(d).

Documents Reviewed: (a) APS Letter to NRC "Notification of Intent to Apply Previously Approved 10 CFR 50 Quality Assurance Program to ISFSI Activities," dated March 15, 2000 (b) APS Letter to NRC "Compliance with 10 CFR 72 Subpart G ISFSI Quality Assurance Requirements," dated October 5, 2001 (c) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (d) NRC Letter to APS "Issuance of an Exemption from the Recordkeeping Requirements of 10 CFR 72.72(d)," dated September 27, 2002 (e) Engineering Study A0-CS-A018 "Classification of Dry Cask Storage and ISFSI Structures, Systems and Components (SSC's)"

Category: QA **Topic:** Boron Loading in Neutron Absorbers

Reference: CoC 1015, App B Tech Spec B.3.2.1(a)

Requirement The minimum B-10 loading in the boral neutron absorbers shall be 0.025 g/cm square for PWR fuel.

Finding: Documentation reviewed for a selected lot of boral neutron absorbers confirmed that the absorbers contained the required 0.025 g/cm square of B-10. The boral neutron absorber properties were controlled by the manufacturer. A sample of each boral lot was tested at the manufacturer's facility to verify B-10 content. The manufacturer's test procedures and acceptance standards had been reviewed and approved by NAC. Applicable boron test results were included in each canister final documentation package provided to Palo Verde. A review of the documentation package, including the boral summary report, receiving inspection checklist, certificate of conformance, chemical analysis and verification of physical dimensions, for the boral pieces in Lot #M-198, containing 218 pieces, confirmed that the absorbers in the lot contained the minimum B-10 requirement of 0.025 g/cm square.

Documents Reviewed: (a) AAR Cargo Systems Boral Summary Report (b) AAR Cargo Systems Boral Data Package Records Checklist (c) AAR Cargo Systems Certificate of Compliance for P.O. Number 1109-10, Rev 1 (d) Ionics, Inc., Receiving Inspection Checklist RI-1109-66, for Boral Lot M-198

Category: QA **Topic:** CoC Issued for Fabrication of Canister

Reference: FSAR 1015, Table 1.2-3

Requirement A Certificate of Conformance shall be issued by the fabricator stating that the canister meets the specifications and drawings.

Finding: The cask vendor, NAC International, was sending Certificates of Conformance to Palo Verde as part of the documentation packages for the casks. Palo Verde was processing the Certificates of Conformance as quality assurance records by including these records in the quality receiving checklist. The Certificate of Conformance for one TSC (UMS-TSC-407-003) and one VCC (PV-VCC-01) were reviewed by the NRC to verify that

they were accepted by Palo Verde and established as quality assurance records.

Documents Reviewed: (a) NAC International Certificate of Conformance for UMS-TSC-407-003 (b) NAC International Certificate of Conformance for UMS VCC PV-VCC-01

Category: QA **Topic:** Control of Measuring and Test Equipment

Reference: 10 CFR 72.164

Requirement The licensee shall establish measures to ensure that tools, gauges, instruments and other measuring and testing devices used in activities affecting quality are properly controlled, calibrated and adjusted at specific periods to maintain accuracy within necessary limits.

Finding: The calibrated helium leak source for the helium mass spectrometer leak detection equipment used to verify the adequacy of the welds on the canister lid was verified to be in calibration. Annual calibrations were required. The calibration sticker on the leak source was dated November 12, 2002 as the date of the last calibration.

Documents Reviewed: Procedure QAP NAC-9.14c "Procedure for Leak Testing of NAC-UMS Transportable Storage Canister Shield Lid Welds," Rev. 0

Category: QA **Topic:** Corrective Actions

Reference: 10 CFR 72.172

Requirement The licensee shall establish measures to ensure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures must ensure that the cause of the condition is determined and corrective action taken to preclude repetition. This must be documented and reported to appropriate levels of management.

Finding: Palo Verde used their Part 50 site corrective action system to document and address ISFSI-related issues. Issues requiring evaluation were documented on condition report disposition records. A number of condition report disposition records were selected and reviewed. Documentation of the issues and corrective actions taken were appropriate for the nature of the problems. An ISFSI sub-category was available in the corrective action program trending capabilities. A sub-category trend analysis report was reviewed and found to provide useful information on occurrence trends and information on the approximate distribution of condition report/disposition request by organization.

Documents Reviewed: (a) Condition Report/Disposition Request (CRDR) # 2399653, 2527321, 2564729, 2546837 (b) Sub-Category Trend Analysis for ISFSI activities

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Category: QA **Topic:** Important to Safety Items

Reference: FSAR 1015, Table 2.3-1

Requirement Components "Important to Safety" and their quality assurance safety classification are listed in Table 2.3-1. The definition of the safety classifications is on page 2.3-1.

Finding: The components "important to safety" listed in the FSAR and their quality assurance classifications had been incorporated into procedures. Procedures 81DP-0CC28 and 87DP-0MC09 appropriately classified and incorporated the ISFSI components into Palo

Verde's quality assurance system. Specifically, ISFSI Category A items were treated the same as safety-related components under the quality assurance program. Category B and C items were treated as quality augmented (QAG). In Appendix B of Procedure 81DP-0CC28, a QAG Program Matrix identified the specific 10 CFR Part 50 Appendix B criteria (III through XVIII) that applied to QAG Class Codes 2.20 and 2.21. The two QAG class codes were created to address dry storage of spent nuclear fuel, Category B and C items with QAG Code 2.20 being used for "important to safety" Category B items and QAG Code 2.21 used for "important to safety" Category C items. These categories established specific 10 CFR 50 Appendix B requirements that must be observed for procurement document control and for control of purchased material, equipment or services.

Documents Reviewed: (a) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (b) Procedure 81DP-0CC28 "Classification of Structures, Systems, and Components" (c) Procedure 87DP-0MC09 "Item Procurement Specification (IPS) Requirements"

Category: QA **Topic:** Nonconforming Material and Parts

Reference: 10 CFR 72.170

Requirement The licensee shall establish measures to control materials, parts or components that do not conform to their requirements in order to prevent their inadvertent use or installation. These measures must include procedures for identification, documentation, segregation, disposition and notification to affected organizations. Nonconforming items must be reviewed and accepted, rejected, repaired, or reworked in accordance with documented procedures.

Finding: The licensee was implementing a nonconformance materials and parts program for ISFSI material using Procedures 12DP-0MC29, 90DP-0IP10 and 81DP-0DC13. The only nonconforming material identified to-date had been documented on Warehouse Discrepancy Notice No. 6000482 due to physical damage found on several concrete casks. Concrete cask VCC #1 was found to have the bolts from the bottom inlet screen pulled loose. Concrete cask VCC #2 had chips in the exterior concrete. Concrete cask VCC #5 had chipped exterior concrete and loose/wrinkled inlet screen. The problems were dispositioned through a condition report/disposition request and a deficiency work order to repair the chipped concrete and the inlet screens.

Documents Reviewed: (a) Procedure 12DP-0MC29 "Warehouse Discrepancy Notice," Rev 12 (b) Procedure 90DP-0IP10 "Condition Reporting," Rev 15 (c) Procedure 81DP-0DC13 "Deficiency Work Order," Rev 13 (d) Warehouse Discrepancy Notice No. 6000482

Category: QA **Topic:** Operating Status

Reference: 10 CFR 72.168(b)

Requirement The licensee shall establish measures to identify the operating status of structures, systems, and components of the ISFSI such as tagging valves and switches to prevent inadvertent operations.

Finding: The licensee was implementing a program for determining the operating status of ISFSI related equipment through the existing Part 50 electronic work order process. The

helium mass spectrometer leak detection system and the helium gas supply system were inspected for tagging to indicate status. The helium mass spectrometer leak detection system was tagged with a temporary material storage tag indicating its status as a temporary piece of equipment in the fuel handling building. The helium gas supply lines were tagged as helium lines, color coded, and included unique fittings that only allowed connection to the helium supply tanks.

Documents Reviewed: Tags on helium mass spectrometer leak detection system and the helium gas supply system

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Category: QA **Topic:** Procurement Controls for Material

Reference: 10 CFR 72.154(a)/(b)/(c)

Requirement The licensee shall establish measures to ensure that purchased material, equipment, and services conform to procurement documents. These measures must include provisions for source evaluation and selection, objective evidence of quality furnished by the contractor/subcontractor, inspection at the contractor/subcontractor source and examination of product on delivery. Records shall be available for the life of the ISFSI. The effectiveness of the control of quality by contractors/subcontractors shall be assessed at intervals consistent with the importance, complexity and quantity of the product or service.

Finding: Procedure 12DP-0MC46 required receipt inspection for all quality related procurement. The receipt inspection was documented on a quality receiving checklist. The quality receiving checklists for three canisters and five concrete casks were reviewed and found to conform with the receipt inspection requirements in the procedure. Procedure 12DP-0MC46 also required that all completed quality receiving checklists be transmitted to the Nuclear Information and Records Management (NIRM) system. The NIRM system required ISFSI records to be maintained for the life of the ISFSI plus 5 years.

Documents Reviewed: (a) Procedure 12DP-0MC46 "Receipt Inspection," Rev 1 (b) Procedure 84DP-0RM30 "Record Control and Turnover," Rev 15 (c) Procedure 78DP-0ZD01 "Dry Cask Storage Documentation Tracking Requirements," Rev 0

Category: QA **Topic:** QA Audits

Reference: 10 CFR 72.176

Requirement The licensee shall carry out a comprehensive system of planned and periodic audits to verify compliance with all aspects of the QA program and to determine the effectiveness of the program.

Finding: A comprehensive quality assurance oversight program was implemented by the licensee including observation of ISFSI work activities and audits of off-site fabrication activities. The nuclear assurance division developed and implemented two quality assurance oversight plans for the ISFSI; one for the off-site fabrication activities and the other for on-site activities including plant modification, ISFSI construction and canister loading. Several surveillance reports related to fabrication activities at Ionics and Hi-Tec were reviewed and found to be comprehensive in scope and documentation with deficiencies identified and tracked through resolution. A joint utility audit of the cask vendor, NAC, led by Palo Verde was reviewed and assessed to be adequate with a

number of findings documented. Follow-up correspondence between NAC and Palo Verde documented resolution of the audit findings. Corrective actions were appropriate for the issues identified. The nuclear assurance oversight department planned and conducted observations of various activities based on reviewing the weekly planned work schedules. This included observation of ISFSI construction activities and activities associated with the loading, sealing and moving of the canister. The observations were documented on nuclear assurance evaluation report forms. A review of a sample of the reports indicated that observations were well documented with corrective action forms initiated when issues were found. A draft audit plan was reviewed for an upcoming audit of ISFSI operations. Audit 03-002 was very comprehensive in the scope of activities to be audited.

Documents Reviewed: (a) Nuclear Assurance Evaluation Reports ER03 0020, 0023, and 0034 (b) ISFSI Readiness Self-Assessment, dated December 19, 2002 (c) NAD Fabrication Oversight Plan of the Dry Cask Storage Project, dated August 22, 2001 (d) NAD Oversight Plan of the Dry Cask Storage Project, dated August 9, 2001 (e) Audit # 03-002 (draft) NAD Audit Plan of PVNGS ISFSI Operations (f) Source Verification SV-NAC1-01-25; fabricator surveillance reports # 2,8 and 14 (g) Source Verification SV-NAC-02-002; fabricator surveillance reports # 1, 9, 17, 27, and 33 (h) NAC Audit A-NAC1-02-03R1, conducted March 4-8, 2002

Category: Radiological **Topic:** Contamination Limits for Canister

Reference: CoC 1015, Tech Spec A.3.2.1

Requirement Removable contamination on the accessible exterior surfaces of the canister or accessible interior surfaces of the transfer cask shall not exceed 1000 disintegrations per minute/100 centimeters squared (dpm/100 cm squared) beta/gamma and 20 dpm/100 cm square alpha prior to transport. FSAR Sect 12, Appendix C, Section C.3.2.1 provides more information.

Finding: The licensee had incorporated new contamination limits granted by the NRC exemption letter dated October 30, 2002 into their procedures. These limits were 10,000 dpm/100 cm square beta-gamma and 1,000 dpm/100 cm square alpha. Procedure 780P-9ZZ02 contained the necessary information for compliance with the FSAR and the Certificate of Compliance requirements to ensure that removable contamination on the exterior surfaces of the canister or accessible interior surfaces of the transfer cask were surveyed and did not exceed the limits specified in the NRC letter. Specifically, Step 8.9.8 of Procedure 780P-9ZZ02 required a contamination surveys of the annulus gap surfaces to verify compliance with the limits. Step 8.10.7 required a contamination survey of the internal surface of the transfer cask shield doors. Step 8.10.21 required a contamination survey of the internal surface of the transfer cask. Step 8.10.39 required a contamination survey of the structural lid. Provided with each of the steps listed above was a table with the NRC approved contamination limits, a reference to Procedure 75DC-9SF01 for directions on conducting the survey and a statement that if removable surface contamination limits were not met, decontamination of the component was to be performed as directed by radiation protection staff. Procedure 75DC-9SF01 established additional administrative limits below the allowable (revised) technical specification limits. The administrative limits were 8,000 dpm/100 cm square beta/gamma and 80 dpm/100 cm square alpha for any single smear and 2,000 dpm/100 cm square

beta/gamma and 40 dpm/100 cm square alpha when averaged over all smears. For the first cask loading, all contamination levels found during the required radiological surveys were below the instrument detection limits of 1,000 dpm/100 cm square beta/gamma and 20 dpm/100 cm square alpha. For the second canister, the licensee's survey of the interior of the transfer cask after the loaded canister had been lowered into the concrete cask, found contamination levels of 50,000 dpm/100 cm square beta/gamma. This exceeded the technical specification limit of 10,000 dpm/100 cm square beta/gamma. The transfer cask was decontaminated. During decontamination, the licensee observed that some of the liquid penetrant used for the weld inspections was found on the transfer cask surface where the contamination problem was encountered. The licensee conducted smear surveys of the loaded canister inside the concrete cask to determine if high contamination levels were also on the canister surface. Twenty smears were taken using a long handle tool to reach down into the gap between the concrete cask and the canister. No alpha contamination was found. Two of the smears indicated beta-gamma contamination with the highest level at 3,000 dpm/100 cm square. This was well below the technical specification limits as well as the licensee's administrative limits. The canister was released by the radiological protection organization and was moved to the ISFSI.

Documents Reviewed: (a) Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 75DC-9SF01 "Radiation Protection Requirements for Dry Cask Storage," Rev 0 (c) NRC Letter to G. R. Overbeck (PVNGS) from NRC "Exemption from the Requirements of 10 CFR 72.212 and 72.214 for Dry Cask Storage," dated October 30, 2002

Category: Radiological **Topic:** Controlled Area Radiological Doses

Reference: 10 CFR 72.106(a)/(b)/(c)

Requirement For each ISFSI, a controlled area must be established. Any individual located on or beyond the nearest boundary of the controlled area may not receive from any design basis accident 5 rem TEDE, or sum of DDE + CDE of 50 rem, or 15 rem to lens of eye, or 50 rem skin/extremities. Minimum distance from ISFSI to nearest boundary of controlled area must be 100 meters. Controlled area may include roads, railroads or waterways as long as arrangements are made to control traffic and protect public.

Finding: The controlled area for the ISFSI was formed by the reactor's exclusion area boundary, which, at the closest point was approximately 4,000 feet from the pad. Dose calculations presented in Section 4.0 of the ISFSI 72.212 Evaluation Report determined that the dose to an individual located at the exclusion area boundary for 8766 hours/year would be considerably less than 1 mrem/year due to normal operations. The FSAR, Chapter 11 "Accident Analysis," stated that no credible accidents were associated with the NAC-UMS cask design that could exceed the 5 rem dose to the public. The onsite rail line and access roads were under administrative and security control to ensure that access was limited only to authorized vehicles and personnel. No public highways, roads, waterways or rail lines traversed the owner controlled area.

Documents Reviewed: (a) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (b) NAC-UMS Final Safety Analysis Report, Rev 2

Category:	Radiological	**Topic:**	Environmental Monitoring Program
Reference:	CoC 1015, Tech Spec A.5.5 & 10 CFR 72.44(d)(2)		
Requirement	A general licensee may incorporate their environmental monitoring program for the ISFSI into their Part 50 program. An annual report shall be submitted pursuant to 72.44(d)(3).		
Finding:	The licensee planned to use their existing reactor environmental monitoring program for monitoring the ISFSI. An annual report for the reactor environmental monitoring program was being submitted to the NRC. The environmental monitoring program had 48 environmental TLDs around the site and in the local area. This included the fence surrounding the ISFSI pad. The 2001 environmental radiation levels ranged from 17.8 to 27.8 millirem per quarter. These values represented background levels and statistically correlated to the environmental radiation levels measured in 1984-1985 prior to reactor operations.		
Documents Reviewed:	(a) "Palo Verde Nuclear Generating Station Independent Spent Fuel Storage Installation 72.212 Evaluation Report," Rev 0 (b) Site Area Monitoring Program, Trending Unit 1		

Category:	Radiological	**Topic:**	Neutron Energies for Dosimetry
Reference:	FSAR 1015, Table 5.2-16		
Requirement	Table 5.2-16 provides the design basis neutron energy spectrum for the canister.		
Finding:	The licensee had evaluated the change in the neutron spectrum that would be encountered during the cask loading and storage activities and had made modifications to the neutron dosimetry program. The licensee performed an analysis of the neutron environments that would exist during various cask activities. The neutron spectra encountered will vary based on the amount and type of shielding (concrete, water, or steel) in place during the various phases of cask loading, sealing and storage. The licensee planned to use two separate personnel neutron dosimeters, worn at different times, to account for these differences. Additionally, the portable neutron survey instruments would require the use of a correction factor when the neutron energies were moderated. The licensee identified three different phases of activities that affect the neutron energies. Phase 1 was when the spent fuel was in the steel canister, filled with water, and inside the steel transfer cask. This would be a moderated spectrum due to the water. The second phase was when the water was drained. This would be a fast spectrum. The third phase was when the spent fuel canister was placed in the concrete cask. This would be a moderated spectrum on the sides due to the concrete and a fast spectrum on top, which had a steel lid for shielding, but no concrete. For the first two phases, personnel dosimeters calibrated for a fast spectrum based on the Health Physics Research Reactor (HPRR) steel moderated spectrum would be used. Even though the spectrum when the canister was filled with water was moderated, the fast neutron dosimeters were adequate because they provide an over-response to the moderated spectrum. The amount of neutron exposure during the first phase is expected to be minimal. For the third phase when the canister was in the concrete cask, a different neutron dosimeter would be worn. The neutron spectrum encountered from the sides of		

the canister were similar to the spectrums encountered during reactor containment entries and would be based on a 15 cm heavy water moderated Cf-252 spectrum. The fast neutron dosimeters would still be required for work on top of the cask. The survey instruments (remballs) used for measuring the neutron fields around the casks would be calibrated to AmBe, which had a fast energy spectrum. For surveys around the steel transfer cask, the calibration values would be appropriate, however, for surveys of the concrete cask, which had an energy spectrum moderated by the concrete, the remball readings would be divided by 2. The correction factor of 2 had been independently substantiated in the Battelle/Pacific Northwest Laboratories Report "Neutron Spectrum Survey at PVNGS, Unit 1," dated June 1986.

Documents Reviewed: "Neutron Dosimetry and Survey Instrument Response for Spent Fuel Dry Cask Storage"

Category: Radiological **Topic:** Radiation Levels for Canister in Transfer Cask

Reference: FSAR 1015, Sect 5.1.3.2

Requirement Table 5.1-3 provides maximum dose rates for the transfer cask.

Finding: Minimal information was provided in Procedure 780P-9ZZ02 and Procedure 75DC-9SF01 concerning expected dose rates during the various cask loading operations. Procedure 75DC-9SF01, Appendix A included a reference to Section 5.1.3.2 of the FSAR for dose rates on the transfer cask, however, none of the FSAR dose rate information had been incorporated into the procedures. In particular, the potential for R/hr levels that could be encountered in the gap between the transfer cask and the canister. Procedure 75DC-9SF01, Section 3.3.2 did include a precaution to immediately notify the radiation protection supervisor and the cask loading coordinator if contact radiation levels on the side of the transfer cask exceeded 250 mrem/hr while in the cask loading pit. The licensee conducted pre-job briefings prior to major work activities which included good discussions of the radiological conditions that could be encountered, including the potential for high radiation levels, contamination problems and special radiological controls that would be in place. Discussions with radiation protection personnel determined that they were knowledgeable of the potential high radiation levels that could be encountered during various work activities. Radiation protection personnel demonstrated excellent radiological controls during both the pre-operational test and the loading of the first canister, including special attention directed toward activities that had the potential for high radiation levels while the canister was in the transfer cask.

Documents Reviewed: (a) Procedure 780P-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3 (b) Procedure 75DC-9SF01 "Radiation Protection Requirements for Dry Cask Storage," Rev 0

Category: Radiological **Topic:** Radiation Limits for Storage Cask

Reference: CoC 1015, Tech Spec A.3.2.2

Requirement The average surface dose rate of each storage cask shall not exceed the following limits a) 50 mrem/hr neutron and gamma on the side, 50 mrem/hr neutron plus gamma on the top and 100 mrem/hr neutron plus gamma at the air inlets and outlets.

Finding: Procedure 78OP-9ZZ02, Step 8.10.55 required measurements of the concrete cask surface dose rates in accordance with Procedure 75DC-9SF01 to verify compliance with

Technical Specification A.3.2.2 limits. Section 13 of Procedure 75DC-9SF01 provided directions for conducting the radiation survey of the concrete cask surfaces upon completing cask closure. The limits specified in Technical Specification A.3.2.2 were specified as the acceptance criteria in Step 13.1.4 of Procedure 75DC-9SF01.

Documents Reviewed: (a) Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations, " Rev 3 (b) Procedure 75DC-9SF01 "Radiation Protection Requirements for Dry Cask Storage," Rev 0

Category: Records **Topic:** Notice of Initial Loading

Reference: 10 CFR 72.212(b)(1)(i)

Requirement The general licensee shall notify the NRC at least 90 days prior to first storage of spent fuel.

Finding: Arizona Public Service complied with the requirement to notify the NRC at least 90 days prior to loading spent fuel into the ISFSI. By letter dated August 27, 2002, Arizona Public Services notified the NRC of their intent to load spent fuel into the ISFSI. Actual loading of the first canister into the ISFSI was March 15, 2003.

Documents Reviewed: APS Letter to NRC "Notification of Intent to Store Spent Fuel at ISFSI," dated August 27, 2002

Category: Records **Topic:** Registration of Casks with NRC

Reference: 10 CFR 72.212(b)(1)(ii)

Requirement The general licensee shall register the use of each cask with the NRC no later than 30 days after using the cask to store spent fuel.

Finding: Palo Verde placed their first cask in the ISFSI on March 15, 2003 and submitted the required 30 day notification letter to the NRC on March 19, 2003. The second cask was placed in the ISFSI on April 15, 2003 and the NRC required letter submitted on April 25, 2003.

Documents Reviewed: (a) APS Letter to the NRC entitled "Registration of Use of Dry Spent Fuel Transportable Storage Canister Identification No. AMZDFX001," dated March 19, 2003 (b) APS Letter to the NRC entitled "Registration of Use of Dry Spent Fuel Transportable Storage Canister Identification No. AMZDFX002," dated April 25, 2003

Category: Safety Reviews **Topic:** Changes, Tests, and Experiments

Reference: 10 CFR 72.48(c)(1)

Requirement A licensee can make changes to their facility or storage cask design if certain criteria are met as listed in this section.

Finding: The licensee had combined the safety evaluation process defined by 10 CFR 72.48 with the reactor facility process for conducting safety reviews under 10 CFR 50.59 into Procedure 93DP-0LC07. The procedure adequately addressed both processes and provided for a means to screen issues to determine if NRC approval was required to make the change. A large number of safety evaluations were reviewed during the inspections conducted of the ISFSI operations. In particular, a significant effort was

directed toward the crane safety evaluations conducted for the modifications to the fuel building crane and the use of the SAFLIFT device. A review of these safety evaluations is provided in the section of this inspection report on heavy loads. Screenings and evaluations were well documented with proper and full justification of the screening questions. A good level of detail was noted as well in the evaluations performed as a result of the screenings.

Documents Reviewed: (a) Procedure 93DP-0LC07 "10 CFR 50.59 and 72.48 Screenings and Evaluations," Rev 6 (b) 10 CFR 50.59 Screening #S-02-0263 "Use of a Single Failure Proof Lifting Device - SAFLIFT," Rev 1 (c) 50.59 Screening #S-02-0388 "Use of Permanent Plant Equipment to Support Universal Storage System Loading and Unloading Operations in the Fuel Building" (d) 50.59 Screening #0443 "Study AO-CS-A019, Dry Cask Storage Travel Path Evaluation," Rev 0 (e) 50.59 Evaluations #E-02-0029 "Review of Fuel Assembly Drop in Cask Pit - Calculation 13-NC-ZY-263, Appendix F," Rev 7 (f) 50.59 Evaluations #0030 "Dry Fuel Storage System (g) 72.48 Screening #S-02-004 "Differences Between PVNGS Ancillary Systems Equipment, System Layout and Operating Pressures and the UMS FSAR Descriptions (h) 72.48 Screening #006 "PVNGS versus UMS FSAR Conditions During Transfer" (i) 72.48 Screening #011 "Dry Cask Storage Travel Path Evaluation"

Category: Security **Topic:** Back-up Power Supply

Reference: 10 CFR 75.55(e)(1) & (f)(4)

Requirement Onsite secondary power supply systems for alarm annunciator equipment and non-portable communications equipment as required in paragraph f must be located within vital areas. Non-portable communications equipment controlled by the licensee and required by this section shall remain operable from independent power sources in the event of the loss of normal power.

Finding: Redacted per SUNSI 2005-31 [redacted]

Documents Reviewed: Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45

Category: Security **Topic:** Compensatory Measures

Reference: 10 CFR 73.55(g)(1)

Requirement The licensee shall develop and employ compensatory measures including equipment, additional security personnel and specific procedures to assure that the effectiveness of the security system is not reduced by failure or other contingencies affecting the operation of the security related equipment or structures.

Finding: Adequate compensatory measures had been identified by the licensee for implementation during periods when security systems were unavailable. Redacted per SUNSI 2005-31 [redacted]

Redacted per SUNSI 2005-31.

Documents Reviewed: (a) Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45 (b) Redacted per SUNSI 2005-31

Category: Security **Topic:** Coordination with Local Law Enforcement Agenc

Reference: 10 CFR 73.55(h)(2) & (h)(4)

Requirement The licensee shall establish and document liaison with local law enforcement authorities. Upon detection of abnormal presence or activity of persons or vehicles within an isolation zone, a protected area, material access area, or a vital area; or upon evidence or indication of intrusion into a protected area, the licensee security organization shall inform local law enforcement agencies of the threat and request assistance.

Finding: The licensee had established a written agreement with Redacted per SUNSI 2005-31

Documents Reviewed: Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45

Category: Security **Topic:** Intrusion Detection System

Reference: 10 CFR 73.55(e)(1)

Requirement All alarms required must annunciate in a continuously manned central alarm station located within the protected area and in at least one other continuously manned station not necessarily onsite.

Finding: All alarms from the ISFSI security systems annunciated in the licensee's central alarm station and at a secondary alarm station. Redacted per SUNSI 2005-31 Redacted per SUNSI 2005-31. The licensee successfully performed functional tests of several ISFSI alarm zones selected by the NRC inspector.

Documents Reviewed: (a) Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45 Redacted per SUNSI 2005-31

Category: Security **Topic:** Lock and Key Controls

Reference: 10 CFR 73.55(d)(8)

Requirement All keys, locks, combinations and related access control devices used to control access to the protected areas must be controlled to reduce the probability of compromise.

Finding: The licensee was using the same lock and key controls for the ISFSI as was used for the reactors. The lock and key program Redacted per SUNSI 2005-31 was found to adequately address the ISFSI. Redacted per SUNSI 2005-31

Documents Reviewed: (a) Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45 (b) Redacted per SUNSI 2005-31

Category: Security **Topic:** Observation of Protected Area

Reference: 10 CFR 72.212(b)(5)(iv)

Requirement The observational capability required by 10 CFR 73.55(h)(6) as applied to a new protected area may be provided by a guard or watchman on patrol in lieu of closed circuit television.

Finding: Redacted per SUNSI 2005-31

Documents Reviewed: (a) Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45 Redacted per SUNSI 2005-31

Category: Security **Topic:** Personnel Search Prior to ISFSI Entry

Reference: 10 CFR 72.212(b)(5)(iii)

Requirement For the purpose of this general license, searches required by 10CFR73.55(d)(1) before admission to a new protected area may be performed by physical pat-down searches of persons in-lieu of firearms and explosives detection equipment.

Finding: Redacted per SUNSI 2005-31

Redacted per SUNSI 2005-31

Documents Reviewed: (a) Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45 (b) Redacted per SUNSI 2005-31

Category: Security **Topic:** Physical Security Organization & Program

Reference: 10 CFR 72.212(b)(5)(i)

Requirement The physical security organization and program for the (reactor) facility must be modified as necessary to assure that activities conducted under this general license do not decrease the effectiveness of the protection of vital equipment in accordance with 10CFR73.55

Finding: The licensee incorporated provisions for security of the ISFSI into the existing site security program. The physical security program for the reactor facility had been modified such that security related activities conducted for the ISFSI would not decrease the effectiveness of the protection of the reactor's vital equipment in accordance with 10 CFR 73.55. Redacted per SUNSI 2005-31

Documents Reviewed: Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45

Category: Security **Topic:** Protected Area

Reference: 10 CFR 72.212(b)(5)(ii)

Requirement Storage of spent fuel must be within a protected area, in accordance with 10CFR73.55(c), but need not be within a separate vital area. Existing protected areas may be expanded or new protected areas added for the purpose of storage of spent fuel.

Finding: Redacted per SUNSI 2005-31

Redacted per SUNSI 2005-31

Documents Reviewed: (a) Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45 (Redacted per SUNSI 2005-31

Category: Security **Topic:** Protected Area Lighting

Reference: 10 CFR 73.55(c)(5)

Requirement Isolation zones and all exterior areas within the protected area shall be provided with illumination sufficient for the monitoring and observation requirements of paragraph (c)(3), (c)(4) and (h)(4) of this section, but not less than 0.2 foot-candles measured horizontally at ground level.

Finding: The licensee had performed light meter readings throughout the ISFSI protected area.
Redacted per SUNSI 2005-31

Documents Reviewed: (a) Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45 Redacted per SUNSI 2005-31

Category: Security **Topic:** Security Guard Force Training

Reference: 10 CFR 73.55(b)(4)(i) & (b)(4)(ii)

Requirement The licensee may not permit an individual to act as a guard or armed response person, or other member of the security organization unless the individual has been trained, equipped and qualified to perform each assigned security job duty in accordance with 10 CFR 73 Appendix B. Each licensee shall establish, maintain, and follow an NRC-approved training and qualifications plan.

Finding: Interviews with security force personnel and review of training records and the Palo Verde Security Initial Training Handbook verified that security force personnel assigned to the ISFSI were trained and qualified in accordance with the requirements in the NRC approved Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan. Observation of security force personnel performing various duties confirmed the

adequacy of their training and knowledge of ISFSI security requirements. [redacted] Redacted per SUNSI 2005-31

Documents Reviewed: (a) Palo Verde Nuclear Generating Station (PVNGS) Physical Security Plan, Amendment 45 ([redacted] Redacted per SUNSI 2005-31

Category: Training **Topic:** Certification of Personnel

Reference: 10 CFR 72.190

Requirement Operations of equipment and controls that have been identified as important to safety in the SAR and in the license must be limited to trained and certified personnel or be under the direct visual supervision of an individual with training and certification in the operation. Supervisory personnel who personally direct the operation of equipment and controls that are important to safety must also be certified in such operations.

Finding: The licensee had developed a qualification program for ISFSI personnel using qualification cards which identified required courses and on-the-job training. Examples of areas incorporated into the qualification program were: operations of ancillary equipment, fuel building cask handling, rail operations, equipment setup, loading and sealing a canister, vertical cask transporter operations and safety screenings/evaluations. The necessary training and qualifications had been implemented for all personnel working with the ISFSI. The status of selected employees' qualifications was verified using the site wide management system (SWMS) database. All ISFSI worker certifications reviewed were found to be current.

Documents Reviewed: (a) Procedure15DP-0TR69 "Training and Qualification Administration," Rev 10 (b) Site Wide Management System (SWMS) database (c) Dry Cask Storage Training Modules

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Category: Training **Topic:** Health Requirement for Certified Personnel

Reference: 10 CFR 72.194

Requirement The physical condition and the general health of personnel certified for the operation of equipment and controls that are important to safety must not be such as might cause operational errors that could endanger other inplant personnel or the public health and safety. Any condition that might cause impaired judgment or motor coordination must be considered in the selection of personnel for activities that are important to safety. These conditions need not categorically disqualify a person if appropriate provisions are made to accommodate such defect.

Finding: The licensee's training program complied with the physical condition requirements in 10 CFR 72.194. Procedure 15DP-0TR69, Page 5 required personnel who make independent work assignments to verify that the person being assigned the task had completed all initial training and qualifications requirements. This included any administrative and physical requirements that were necessary to maintain qualifications. The licensee tracked employees with conditions that could cause impaired judgment or motor coordination. The most serious physical condition identified by the licensee was

ISFSI workers requiring glasses or contact lenses for vision correction. Seven ISFSI employees required some form of vision correction.

Documents Reviewed: (a) Procedure 15DP-0TR69 "Training and Qualification Administration," Rev 10 (b) Site Wide Management System (SWMS) database,

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Category: Training **Topic:** Training Program

Reference: CoC 1015, Tech Spec A.5.1

Requirement A training program shall be developed under the general licensee's systematic approach to training (SAT). Training modules shall include comprehensive instructions for the operations and maintenance of the cask and ISFSI.

Finding: A comprehensive training program was developed for cask loading activities and the operations and maintenance of the ISFSI. The dry cask storage training modules included an overview of the dry cask storage program at Palo Verde with special topics related to ancillary equipment, fuel building crane operations, spent nuclear fuel, ISFSI operations, technical specifications for the NAC-UMS system, emergency coordinator responsibilities related to ISFSI activities, Delta V maintenance training, 10 CFR 72.48 safety evaluations and use of the intrepid micropoint cable system. The Site Wide Management System (SWMS) was used to track the status of training using an employee training and qualification card concept. Employees had access to SWMS and could check their current status of training and qualifications. SWMS listed expiration dates for training and qualifications so that employees could be cognizant of their need to renew their training. When employees approached expiration for general employee refresher training, an e-mail was sent to the individual as a reminder that training was coming due. When employees completed their refresher training, the information in SWMS was updated. Back-up to SWMS was provided by multiple systems to ensure that employee records were not lost.

Documents Reviewed: Dry Cask Storage Training Modules

Category: Welding/NDE **Topic:** Hydrogen Gas Monitoring

Reference: FSAR 1015, Sect 3.4.1.2.2

Requirement FSAR Section 3.4.1.2.2, under "Loading Operations," specifies that "the hydrogen detector shall be mounted so as to detect hydrogen prior to welding and continuously during welding." The system shall be capable of detecting 60% LEL which is 2.4% hydrogen. If hydrogen is detected above 2.4%, stop welding and remove the hydrogen gas by flushing ambient air in the region below the shield lid. Note: FSAR Section 8.1.1.21 also discusses hydrogen monitoring.

Finding: Procedure 78OP-9ZZ02, Step 7.3.10 incorporated the requirement for purging and hydrogen monitoring prior to and during the root pass welding. Step 7.3.10.8 required purging and monitoring to be in service for at least 15 minutes prior to welding. Step 7.4.5 required welding to be stopped if the hydrogen detector alarms. The alarm set point was stated as 2.4% hydrogen. Welding could not resume until the hydrogen concentration was reduced below the 2.4% level and the alarm cleared. Approval of the cask loading coordinator was also needed to resume welding. During the root pass welding of the first canister, no hydrogen was detected.

Documents Reviewed:	Procedure 78OP-9ZZ02 "NAC-UMS Cask Loading Operations," Rev 3

Category:	Welding/NDE **Topic:** Weld Exam - NDT Qualified Personnel
Reference:	FSAR 1015, Sect 7.1.3.3.9
Requirement	Individuals qualified for NDT Level I, NDT Level II or NDT Level III may perform nondestructive testing. Only Level II or Level III personnel may interpret the results of an examination or make a determination of the acceptability of examined parts.
Finding:	Procedure QAP 9.6, Section 3.2 and Procedure QAP 9.16, Section 3.2 required individuals performing examinations to be certified to a minimum of NDE Level I per WSI Procedure QAP 2.7 and for individuals evaluating and accepting or rejecting examination results to be certified to a minimum of NDE Level II. Documentation, including the ISI Certification Review Summary Sheets and WSI Certification of Qualification were reviewed against the requirements of WSI Procedure QAP 2.7 for the individuals that performed the weld examinations during the loading of the first canister. All individuals met the requirements for Level II visual testing (VT) and liquid penetrant testing (PT).
Documents Reviewed:	(a) WSI Procedure QAP 9.6 "Liquid Penetrant Inspection Procedure," Rev 7 (b) WSI Procedure QAP 9.16 "High Temperature Liquid Penetrant Inspection Procedure, Using Color Visible/Solvent Removable Penetrant Technique," Rev 1 (c) WSI Procedure QAP 2.1 "Selected, Training, Qualification and Certification of Quality Control Inspection and Test Personnel to ANSI N45.2.6 and ANSI/ASME NQA-1," Rev 9 (d) WSI Procedure QAP 2.7 "Selection, Training, Qualification and Certification of Non-Destructive Testing Personnel," Rev 7 (e) APS "ISI Certification Review Summary Sheet," dated February 3, 2003 for Welding Services, Inc. NDE and Welding Personnel (f) Welding Services, Inc., "Certification of Qualification"

Category:	Welding/NDE **Topic:** Weld Exam - Progressive PT on Structural Lids
Reference:	CoC 1015, Table B.3-1 & FSAR 1015, Sect 7.1.3.3.7
Requirement	Field installed welds that are not ultrasonically inspected will be root and final surface liquid penetrant (PT) inspected or progressive (i.e., at weld thickness intervals not to exceed 0.375 inch) PT examined to ensure detection of critical weld flaws.
Finding:	Traveler #32017-01specified that the root weld and each intermediate layer, not to exceed 3/8" weld deposit thickness, shall have a visual (VT) and a liquid penetrant (PT) examination. This was specified in Hold Points 6.8, 6.9 and 6.10 in Traveler #32017-01. The pre-operational welding demonstration observed by the NRC included a visual and liquid penetrant examination of the root weld and first 3/8" intermediate weld on the structural lid. The welding was performed in accordance with WSI Weld Procedures WPS 08-08-TS-001 and WPS 08-08-T-901. The visual and liquid penetrant inspections were performed in accordance with WSI procedures QAP 9.3, QAP 9.6 and QAP 9.16. The weld filet size requirements and the VT/PT examination requirements specified in Traveler # 32017-01 were in accordance with the applicable drawings referenced by NAC International Transportable Storage Canister, (TSC) NAC-UMS Project 790, Drawing 085, Revision 13.

Documents Reviewed: (a) WSI Traveler # 32017-01 "Procedure for Welding and NDE of Transportable Storage Canisters," Rev 0 (b) APS SDOC No. A0-CN014K-A00007 (c) NAC International Transportable Storage Canister, (TSC) NAC-UMS Project 790, Drawing 085, Rev 13 (d) WSI Weld Procedure WPS 08-08-TS-001, Rev 2 (e) APS Log Number AO-CN014K-A00009-0 (f) WSI Weld Procedure WPS 08-08-T-901, Rev 0 (g) APS Log Number AO-CN014K-A00013-0 (h) WSI Procedures QAP 9.3 "Workmanship and Visual Inspection Criteria for ASME Welding," Rev 12 (i) Corresponding APS Log Number AO-CN014K-A00010-0 (j) WSI Procedure QAP 9.6 "Liquid Penetrant Inspection Procedure," Rev 7 (k) Corresponding APS Log Number AO-CN014K-A00011-0 (l) WSI Procedure QAP 9.16 "High-Temperature liquid Penetrant Inspection Procedure, Using Color Visible/Solvent Removable Penetrant Technique (Temperature Range: 100F to 300F)," Rev 1 (m) Corresponding APS Log Number AO-CN014K-A00012-0.

Category: Welding/NDE **Topic:** Weld Exam - PT of Lid Welds

Reference: CoC 1015, App B Table B.3-1

Requirement Root and final surface liquid penetrant examination of the lid welds and vent/drain port cover welds will be performed per ASME Code Section V, Article 6 with acceptance in accordance with ASME Code, Section III, NB-5350

Finding: Traveler #32017-01 provided the procedures, references, hold points and signature documentation required to perform welding and non-destructive examinations on the lid welds and the vent/drain port welds, including the requirement to perform a liquid penetrant examination on the root pass, final pass and any intermediate welds approaching 3/8". Procedure QAP 9.6 for the liquid penetrant examination and corresponding APS Log Number AO-CNO14K-A00011-0 had incorporated the requirements from ASME Section V, Article 6, 1995. Procedure QAP 9.16 for the high temperature liquid penetrant examination and corresponding APS Log Number A0-CN014K-A00012-0 had incorporated the requirements from ASME Section V, Article 6, 2001. Both procedures incorporated the acceptance requirements specified in ASME Code Section III, NB-5350. ASME Code Section V, Article 6 required the liquid penetrant written procedures to include the following information: 1) the materials, shapes or sizes to be examined, 2) type of each penetrant, penetrant remover, emulsifier and developer, 3) processing details for pre-examination cleaning and drying, 4) processing details for applying the penetrant, 5) processing details for applying the developer, and 6) processing details for post-examination cleaning. Welding Services Inc. performed the required qualification testing to ensure that the high temperature penetrant would function adequately. The welding demonstrations observed by the NRC included the tack welding of the structural lid, the root pass weld and the first 3/8" intermediate weld. Visual and liquid penetrant examinations of the root weld and intermediate weld were observed and were conducted in accordance with the traveler and Procedures QAP 9.6 by Certified Level II visual/liquid penetrant examination inspectors. Weld examinations were also observed for the first cask loaded and were performed in accordance with the traveler and Procedure 9.6.

Documents Reviewed: 1) WSI Procedure QAP 9.6 "Liquid Penetrant Inspection Procedure," Rev 7 (b) Corresponding APS Log Number AO-CNO14K-A00011-0 (c) WSI Procedure QAP 9.16 "High Temperature Liquid Penetrant Inspection Procedure, Using Color Visible/Solvent Removable Penetrant Technique," Rev 1 (d) Corresponding APS Log Number A0-

CN014K-A00012-0 (e) WSI Traveler #32017-01 "Procedure for Welding and NDE of Transportable Storage Canisters," Rev 1 (f) APS Log Number AO-CNO14K-A00007-1

Category: Welding/NDE **Topic:** Weld Exam - PT/UT Qualified Personnel

Reference: CoC 1015, Table B.3-1

Requirement The examination of the welds on the canister lid will be performed by qualified personnel per ASME Code Section V, Articles 5 (UT) and 6 (PT) with acceptance per ASME Code Section III, NB-5332 (UT) per 1997 Addenda and NB-5350 for (PT).

Finding: All weld examinations performed at the Palo Verde site on the cask lid were performed using liquid penetrants (PT). No ultrasonic testing (UT) of welds was performed. Qualification records for the Level II inspectors assigned to perform the weld examinations were reviewed and found to document their certification in accordance with ASME Code Section V, Article 6 to perform liquid penetrant examinations in accordance with ASME Code Section III, NB-5350. A review of their qualifications listed in the Welding Services, Inc., "Certificate of Qualification," documented completion of the training requirements of WSI Procedure QAP 2.7 for Level II penetrant testing. A review of the APS, "ISI Certification Review Summary Sheet," dated February 3, 2003 documented that the certification records for the Welding Services Inc. Level II inspectors had been reviewed and approved by the APS Senior ISI Engineer/Welding Engineer. In addition, the weld examiners had completed refresher training during May 2002 and June 2002 and had passed the annual vision testing.

Documents Reviewed: (a) Welding Services, Inc., "Certificate for Qualification" (b) WSI Procedure QAP 9.3 "Workmanship and Visual Inspection Criteria for ASME Welding," Rev 12 (c) WSI Procedure QAP 2.1 "Selected, Training, Qualification and Certification of Quality Control Inspection and Test Personnel to ANSI N45.2.6 and ANSI/ASME NQA-1," Rev 9 (d) WSI Procedure QAP 2.7 "Selection, Training, Qualification and Certification of Non-Destructive Testing Personnel," Rev 7 (e) APS "ISI Certification Review Summary Sheet," dated February 3, 2003 for Welding Services, Inc. NDE and Welding Personnel.

Category: Welding/NDE **Topic:** Weld Exam - Visual Acceptance

Reference: FSAR 1015, Sect 9.1.1 & 9.1.1.1

Requirement Section 9.1.1.1 states all welds are visually inspected for defects prior to the nondestructive examinations. The visual examinations of the canister welds are performed in accordance with the ASME Code Section V, Article 9. Acceptance criteria for the visual examinations of the canister welds are in accordance with ASME Code Section III, NB-4424 and NB-4427. Also, FSAR Section 9.1.1 states that acceptance criteria for the visual examination of the canister welds are in accordance with ASME Code, Section VIII, Division I, UW-35 and UW-36

Finding: Procedure QAP 9.3 and corresponding APS Log No. A0-CN014K-A00010-0 had incorporated the ASME code requirements for visual inspections consistent with Article 9, Section V.

Documents Reviewed: (a) WSI Procedure QAP 9.3 "Workmanship and Visual Inspection Criteria for ASME Welding," Rev 12 (b) Corresponding APS Log No. A0-CN014K-A00010-0

Category: Welding/NDE **Topic:** Weld Exam - Visual Qualified Personnel

Reference: FSAR 1015, Sect 9.1.1

Requirement Qualified personnel perform all visual inspections according to written and approved procedures.

Finding: The two Welding Services Inc. personnel who performed the non-destructive examinations during the pre-operational demonstration on November 12-13, 2003 and during the loading of the first canister were qualified in visual inspection techniques and followed written procedures during the examinations. Welding Services, Inc., "Certificate of Qualification" documented that both inspectors had completed the training requirements specified in Procedures QAP 2.1, QAP 2.6, QAP 2.7, and QAP 9.3 and were certified Level II visual testing (VT) inspectors. Documentation was also provided confirming that both individuals had passed an annual vision test. In addition, the Welding Services Inc. Quality Control Manager was a certified Level II VT and liquid penetrant (LP) inspector.

Documents Reviewed: (a) WSI Procedure QAP 9.3 "Workmanship and Visual Inspection Criteria for ASME Welding," Rev 12 (b) Corresponding APS Log No. A0-CN014K-A00010-0 (c) WSI Procedure QAP 2.1 "Selection, Training, Qualification and Certification of Quality Control Inspection and Test Personnel to ANSI N45.2.6 and ANSI/ASME NQA-1," Rev 9 (d) WSI Procedure QAP 2.6 "Selection, Training, Qualification, and Certification of Visual Examination Personnel," Rev 5 (e) WSI Procedure QAP 2.7 "Selection, Training, Qualification, and Certification of Non-Destructive Testing Personnel," Rev 7 (f) APS Log Number AO-CN014K-A00010-0.

Category: Welding/NDE **Topic:** Weld Exam - Written Report

Reference: FSAR 1015, Sect 7.1.3.3.5

Requirement A written report of each weld examined is prepared. At a minimum, the written report will include: identification of part, material, name and level of examiner, NDE procedures used and the finding or disposition, if any.

Finding: Procedure QAP 9.6, Section 7.0 and Procedure 9.16, Section 7.0 required a written report to document each liquid penetrant examination of the welds. The report was required to contain specific information including identification of parts inspected, name and level of examiner, NDE procedures used and the finding or disposition. Included with both procedures was an attachment entitled "Liquid Penetrant Inspection Report" to be used for documenting the information. NAC Document No. 407-S-21, Section 12.0 "Documentation" required the original of all documents that comprised the Final Data Package, which included the non-destructive testing documentation, to be submitted to Arizona Public Service by Welding Services, Inc. The welding documents would be maintained in accordance with Palo Verde's Records Management program.

Documents Reviewed: (a) WSI Procedure QAP 9.6 "Liquid Penetrant Inspection Procedure," Rev 7 (b) WSI Procedure QAP 9.16 "High Temperature Liquid Penetrant Inspection Procedure, Using Color Visible/Solvent Removable Penetrant Technique," Rev 1 (c) NAC Document 407-S-21 "Fabrication Specification for Field Closure Welding of NAC-UMS transportable Storage Canisters at APS' Palo Verde Nuclear Generating Station," Rev 0 (d) APS Procedure 87DP-0CC08 "Control of Vendor Documentation," Rev 8

Category: Welding/NDE **Topic:** Weld Filler Material

Reference: FSAR 1015, Table 1.2-3

Requirement All filler metals shall be appropriate ASME material.

Finding: A review of fabrication specifications and purchase orders determined that requirements for the purchase of weld filler material had been established in accordance with the ASME code and that the weld wire and shims purchased for the welding demonstrations met the purchase order requirements. NAC International Document 790-S-21, Section 7.3.2 required weld filler material and consumables to be procured in accordance with ASME Code Section II and to be identified by heat/lot/batch number, chemical analysis and other specification requirements. Section 7.4.1 required records to be generated that would relate canister closure welds to the certified material test reports. The licensee was controlling the welding filler material purchases using Procedures 73DP-9WP05 and 12DP-0MC08. The requirements in the two procedures related to the ASME code and the process for controlling material were reviewed against the purchase orders used to purchase the weld wire and the shims. The procedural requirements, including the ASME code requirements, had been incorporated into the purchase orders. The weld wire on two spools used during the structural lid weld demonstration was examined and found to comply with the specifications on Purchase Order #500261292, the certified material test reports and the quality receiving checklists. In particular, the weld filler material (2 locked spools) on the WSI welding equipment was found to be 30# spools of ER 308 L, .035", AWS-A5.9, ASME SFA 5.9, Lot # XM793. In addition, the weld wire complied with the requirements specified in the WSI Welding Procedure Specifications WPS 08-08-TS-001and WPS 08-08-T-901. The shim stock was examined and found to comply with the requirements in Purchase Order #500261161. The weld wire and shim stock was procured by Palo Verde from Welding Services Inc.

Documents Reviewed: (a) NAC International Document 790-S-21 "Fabrication Specification For Field Closure Welding of NAC-UMS Transportable Storage Canisters," Rev 2 (b) Procedure 73DP-9WP05 "Weld Filler Material Control," Rev 5 (c) Procedure 12DP-0MC08 "Control of Purchasing Material and Equipment," Rev 16 (d) WSI Welding Procedures WPS 08-08-TS-001, Rev 2 (e) APS Log Number AO-CN014K-A00009-0 (f) Procedure WPS 08-08-T-901, Rev 0 (g) APS Log Number AO-CN014K-A00013-0 (h) APS Weld Wire Purchase Order # 500261292, dated January 14, 2003 (i) APS Shim Purchase Order # 500261161, dated January 14, 2003 (j) WSI Weld Filler Material Certificate of Compliance # 32017B, dated January 27, 2003 (k) ARCOS Weld Filler Material CMTR, dated November 5, 2002

Category: Welding/NDE **Topic:** Weld Integrity Record

Reference: FSAR 1015, Sect 7.1.3.3.8

Requirement The results of the liquid penetrant examination, including all relevant indications, are recorded by video, photographic or other means to provide a retrievable record of weld integrity.

Finding: Procedure QAP 9.6, Step 7.2.12 and Procedure QAP 9.16, Step 7.2.12 required documenting on the Liquid Penetrant Inspection Report the location of any relevant indications found during the liquid penetrant examinations of the welds. Palo Verde does not plan to record relevant indications by video or photo, but plans to make a

drawing of any weld indications not reworked on the final weld of the structural lid. Design Change Request No. DCR 790-FSAR-2F changed the FSAR, Section 7.1.3.3.8 to apply only to the liquid penetrant examination of the final interpretation of the structural lid. This change will be issued in Amendment 3 of the FSAR. NAC International 10 CFR 72.48 Determination Checklist ID# NAC01-UMS-059-Design Change Request No. LCR 1015-20 screened this change to the current Revision 2 of the FSAR as not requiring NRC approval.

Documents Reviewed: (a) WSI Procedure QAP 9.6 "Liquid Penetrant Inspection Procedure," Rev 7 (b) WSI Procedure QAP 9.16 "High Temperature Liquid Penetrant Inspection Procedure, Using Color Visible/Solvent Removable Penetrant Technique," Rev 1 (c) Design Change Request No. DCR 790-FSAR-2F "Revision to FSAR," dated August 30, 2002 (d) NAC International 10 CFR 72.48 Determination Checklist ID# NAC01-UMS-059 "Design Change Request No. LCR 1015-20"

Category: Welding/NDE **Topic:** Weld Procedures Qualified

Reference: FSAR 1015, Sect 7.1.3.2

Requirement All welding procedures shall be written and qualified in accordance with ASME Section IX.

Finding: All welding procedures reviewed were found to be written and qualified in accordance with ASME Section IX. ASME Section IX, Article II, "Welding Procedure Qualifications," required the manufacturer and contractor to prepare written welding procedure specifications (WPS). ASME Section IX, Article II, QW-256, "Welding Variables and Procedure Specifications," listed the variables (e.g., weld joints, base metals, filler materials, gas type, etc.) that were essential to qualify a procedure in accordance with the ASME Code for Gas Tungsten-Arc Welding. Welding Procedure Specification WPS 08-08-TS-001 and APS Log No. A0-CN014K-A00009-0 contained the applicable information required by ASME Code Section IX. The welding procedure specifications prepared by Welding Services Inc., contained all the essential, non essential and required supplemental variables. Section 3.12.1 of Procedure 73DP-9WP04 required the licensee's welding engineer to review and approve the welding procedure prior to welding. A review of Welding Procedure Specification WPS 08-08-TS-001 and APS Log No. A0-CN014K-A00009-0 verified that the Palo Verde welding engineer had reviewed and approved the welding procedures prior to the welding demonstration, as required.

Documents Reviewed: (a) Traveler # 32017-01(APS Document # APS SDOC No. A0-CN014K-A00007) "Procedure for Welding and NDE of Transportable Canister," Rev 1 (b) WSI Welding Procedure Specification WPS 08-08-TS-001, Rev 2 (c) APS Log No. A0-CN014K-A00009-0 (d) Procedure 73DP-9WP04 "Welding and Brazing Control," Rev 7 (e) WSI Welding Procedure WPS 08-08-T-901, Rev 0 (f) APS Log Number AO-CN014K-A00013-0.

Category: Welding/NDE **Topic:** Weld Repairs

Reference: FSAR 1015, Sect 9.1.1 & 9.1.1.1

Requirement Required weld repairs on the canister are performed in accordance with ASME Code

Section III, NB-4450 and are re-examined in accordance with the original acceptance criteria.

Finding: Traveler # 32017-01 stipulated that minor in-process repair operations by mechanical conditioning and re-welding will be determined on a case by case basis by the WSI Site Welding Supervisor and Site QA/QC Supervisor as required to repair unacceptable indications in the in-process welds. The traveler required that repairs were to be performed in accordance with ASME Section III, Subsection NB, Article 4450, 1995 Edition including 1995 Addenda.

Documents Reviewed: (a) WSI Procedure "Procedure for Welding and NDE of Transportable Storage Canisters" (b) Traveler # 32017-01(APS Document # APS SDOC No. A0-CN014K-A00007) "Procedure for Welding and NDE of Transportable Canister," Rev 1

Category: Welding/NDE **Topic:** Welder Qualifications

Reference: FSAR 1015, Sect 7.1.3.2

Requirement All welders and welding operators shall be qualified in accordance with ASME Section IX.

Finding: A review of the ISI Certification Review Summary Sheet and discussions with the Welding Services Inc., (WSI) Welding Supervisor and Palo Verde Senior ISI Engineer/Welding Engineer confirmed that the welders selected for the first cask loading operations were qualified in accordance with ASME Section IX. WSI will be welding the canisters using manual and machine gas tungsten arc welding.

Documents Reviewed: (a) ASME Section IX, Articles III, IV and V, 1995 (b) WSI Welder or Welding Operator Performance Qualification (c) WSI ASME-Welder Maintenance Log (WML) (d) APS "ISI Certification Review Summary Sheet," dated February 3, 2003 for Welding Services, Inc. NDE and Welding Personnel

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Category: Welding/NDE **Topic:** Welds in Accordance with Drawings

Reference: FSAR 1015, Table 1.2-3

Requirement All welds shall be in accordance with the reference drawings.

Finding: The licensee had incorporated the drawing requirements for the structural lid welds into the welding procedures and travelers. Traveler 32017-01 included weld fillet sizes, material requirements and nondestructive testing requirements for the structural lid consistent with the requirements in Drawing 085. During the pre-operational test, the licensee demonstrated welding on the structural lid using Procedures WPS 08-08-TS-001 and WPS 08-08-T-901 and successfully completed the welds in accordance with drawing requirements.

Documents Reviewed: (a) Traveler # 32017-01(APS Document # APS SDOC No. A0-CN014K-A00007) "Procedure for Welding and NDE of Transportable Canister," Rev 1 (b) NAC International Transportable Storage Canister (TSC) NAC-UMS Project 790 drawing 085, Rev 13 (c) WSI Traveler 32017-01 "Procedure for Welding and NDE of Transportable Storage Canisters," Rev 1 (d) APS Log Number AO-CNO14K-A00007-1 (e) WSI Welding Procedures WPS 08-08-TS-001, Rev 2 (f) APS Log Number AO-CN014K-A00009-0 (g) WSI Weld Procedures WPS 08-08-T-901, Rev 0 (h) APS Log

Number AO-CN014K-A00013-0 (i) APS Log Number AO-CN014K-A00012-0 (j) NAC International Design Change Request No. 790-FSAR-2S, dated December 9, 2002

PALO VERDE ISFSI INSPECTION 72-44/2002-03

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