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10 CFR 72.212(b)(1)(ii)
NAC-UMS Technical Specification A 5.3

102-04950-SAB/TNW/GAM
June 4, 2003

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Unit 2 and Independent Spent Fuel Storage Installation (ISFSI)
Docket Nos. STN 50-529 and 72-44
Registration of Dry Spent Fuel Transportable Storage Canister
Identification No. AMZDFX003 and Report of Cask Performance

In accordance with 10 CFR 72.212(b)(1)(ii), Arizona Public Service Company (APS) is registering the use of a dry spent fuel storage cask to store spent fuel under a 10 CFR Part 72 general license at the PVNGS Independent Spent Fuel Storage Installation (ISFSI). The information below is provided for transportable storage canister (TSC) identification no. AMZDFX003 used to store spent fuel within vertical concrete cask (VCC) no. AMZDNE003 beginning on May 15, 2003.

This cask contains a heat load of approximately 10.17 kW. Since this is the first NAC-UMS dry cask system placed in service at PVNGS with a heat load greater than 10 kW, a report of the heat transfer characteristics and performance of this cask was produced by NAC International in accordance with the requirements of NAC-UMS Technical Specification A 5.3, "Special Requirements for the First System Placed in Service." This report is provided as an attachment to this letter. The report concludes that the measured temperature data demonstrates that the thermal models and analysis results reported in the NAC-UMS FSAR correctly represent the heat transfer characteristics of the storage system.

Licensee's Name:

Arizona Public Service Company (APS) is the operating agent for the seven PVNGS owner licensees.

PVNGS Units 1, 2, and 3 have seven owners who are licensees. The owners/licensees are APS, Salt River Project Agricultural Improvement and Power District, El Paso Electric Company, Southern California Edison Company, Public Service Company of New Mexico, Los Angeles Department of Water and Power, and Southern California Public Power Authority. According to the PVNGS operating licenses, APS is authorized to act as agent for the PVNGS licensees and has exclusive responsibility and control over the physical construction, operation and maintenance of the facility.

Licensee's Address: Arizona Public Service Company
P. O. Box 52034
Phoenix, AZ 85072-2034

Reactor: Palo Verde Nuclear Generating Station Unit 2

License Number: NPF-51

Docket Number: STN 50-529

Contact Name and Title: Thomas N. Weber, Section Leader, Licensing

Cask Certificate No.: Certificate of Compliance No. 1015, Amendment No. 2, December 31, 2001

Cask Model No.: NAC-UMS

Cask Identification Nos.: Transportable Storage Canister (TSC) Identification No. AMZDFX003
Vertical Concrete Cask (VCC) Identification No. AMZDNE003

No commitments are being made to the NRC by this letter.

Should you have any questions, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,

SAB/TNW/GAM

Attachment: NAC International's Report on the Thermal Performance of the NAC-UMS System at the Palo Verde Nuclear Generating Station (PVNGS) Independent Spent Fuel Storage Installation

cc: Regional Administrator [NRC Region IV]
J. N. Donohew [NRC/NRR Project Manager]
N. L. Salgado [NRC Senior Resident Inspector]
S. C. O'Connor [NRC SFPO]
A. V. Godwin [ARRA]

Attachment

NAC International's Report on the Thermal Performance of the NAC-UMS System at the Palo Verde Nuclear Generating Station (PVNGS) Independent Spent Fuel Storage Installation

NAC INTERNATIONAL

Western U.S. Operations
841 Blossom Hill Road, Suite 205
San Jose, CA 95123
Phone 408-229-6240
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May 30, 2003
407-03-029

Mr. Brian Hansen
Section Lead, Nuclear Fuel Management
Arizona Public Service Company
Palo Verde Nuclear Generating Station
P.O. Box 52034, MS 7693
Phoenix, AZ 85072-2034

Subject: Transmittal of NAC's "Report on the Thermal Performance of the NAC-UMS® System at the Palo Verde Nuclear Generating Station (PVNGS) Independent Spent Fuel Storage Installation"

Reference: APS letter, 497-00123-BJH, from Brian J. Hansen (APS) to Norman Eng (NAC International), dated May 28, 2003

Dear Mr. Hansen:

NAC has completed its review of the thermal test data supplied by APS (in the referenced letter) for the first storage system placed in service with a heat load equal to or greater than 10 kW. In accordance with the requirements stipulated in the NAC-UMS® Technical Specifications and the Final Safety Analysis Report, NAC has performed an evaluation of the APS temperature measurements taken for Cask #3 after placement on the ISFSI storage pad in order to confirm the heat transfer characteristics of the NAC-UMS® System. The results of this evaluation are documented in the attached report.

If you have any questions concerning the information provided herein, please feel free to contact Dr. Gerry Jones at (678) 328-1230 or me at (678) 328-1224.

Very truly yours,

Norman Eng

Norman Eng
Project Manager

Attachment

Report on the Thermal Performance of the NAC-UMS® System

At

The Palo Verde Nuclear Generating Station (PVNGS) Independent Spent Fuel Storage Installation

By

NAC International

May 30, 2003

Report on the Thermal Performance of the NAC-UMS® System at The Palo Verde Nuclear Generating Station (PVNGS) Independent Spent Fuel Storage Installation

1.0 Purpose

This report provides an evaluation of the temperature measurements taken on the PVNGS ISFSI pad to confirm the heat transfer characteristics of the NAC-UMS® System. The intent of this report is to verify compliance with the thermal performance specifications of the NAC-UMS® Certificate of Compliance (C of C), Reference 7.1.

2.0 Background

The Technical Specification, A5.3, of Appendix A to the NAC-UMS® C of C, Reference 7.1, Special Requirements for the First System Placed in Service states;

"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 equal to or greater than 10kW. A letter report summarizing the results of the measurements will be submitted to the NRC in accordance with 10 CFR 72.4 within 30 days of placing the loaded cask on the ISFSI pad. The report will include a comparison of the calculated temperatures of the NAC-UMS® SYSTEM heat load to the measured temperatures. A report is not required to be submitted for the NAC-UMS® SYSTEMs that are subsequently loaded, provided that the performance of the first system placed in service with a heat load ≥ 10 kW, is demonstrated by the comparison of the calculated and measured temperatures."

Furthermore the Technical Specification, Section A 1.1 Definitions, defines "OPERABLE" as:

"The CONCRETE CASK heat removal system is OPERABLE if the difference between the ISFSI ambient temperature and the average outlet air temperature is ≤ 102 °F for the PWR CANISTER or 92°F for the BWR CANISTER."

3.0 Introduction

The NAC-UMS® System is currently being used by Arizona Power Services (APS), under 10 CFR Part 72 General License, to store spent fuel at the Palo Verde Nuclear Generating Station (PVNGS) Independent Spent Fuel Storage Installation (ISFSI). As of the date of this report there have been three casks loaded with spent fuel and placed into storage in the NAC-UMS® Vertical Concrete Casks (VCC s) on the ISFSI at PVNGS. The third cask is the first NAC-UMS® System having a decay heat load ≥ 10 kW. The actual heat load for this cask from Reference 7.6 was 10.17 kW. In accordance with the

NAC-UMS® C of C Technical Specifications, Reference 7.1, and the NAC-UMS® Final Safety Analysis Report (FSAR), Reference 7.2, this report documents the temperature measurements for the first NAC-UMS® System placed in service with a decay heat ≥ 10 kW.

4.0 Measurement Procedure

The Temperature Monitoring System (TMS) collects and displays ISFSI cask and pad temperatures. Input to the TMS for cask outlet temperature is provided by RTDs that are mounted in each of the outlet vents (four RTDs total) on each cask. These RTDs are wired in series such that an average value for each cask is computed and displayed by the TMS. Input to the TMS for ambient (cask inlet) temperature is provided by an RTD that is mounted on the pad in the center of a four cask (quad) array. The Delta T that is displayed for each cask is the difference between the cask average outlet temperature and the ambient temperature for the cask array.

5.0 Results

5.1 Measured Data

Four days after the third NAC-UMS® System was loaded on the ISFSI, the average air outlet and ambient temperatures were recorded at one-hour intervals. The recorded data was transmitted to NAC by an APS letter, Reference 7.6. The transmitted data is shown in Table 5.1. The outlet and ambient temperature data was averaged over a 24 hour period. The average Delta T (ΔT) was then calculated from the difference between the daily average for the outlet temperature and the daily average for the ambient temperature. The daily average difference between the outlets and the ambient was 53 °F.

5.2 Analytical Results

Steady state analyses were performed using a 2-D finite element model, as discussed in Section 4.4.1.1 of the NAC-UMS® FSAR, to calculate the difference between the inlet and outlet temperatures for the heat load cases of 17kW, 21kW, 23 kW and 24.5 kW. The calculated difference between the ambient temperature and the average outlet temperature is shown in Table 5.2. The results in Table 5.2 are used to calculate the temperature difference for 10.17 kW by performing a regression analysis assuming a linear curve fit. This process produces an equation that can be used to calculate the temperature difference at 10.17 kW. The resultant curve fit and the calculated equation is shown in Figure 5.1. This figure also shows a correlation coefficient of $R^2 = 0.9945$. This value is also commonly referred to as the "goodness of fit" and measures of how well the assumed form of the fitted curve matches the data. This verifies that the original assumption of a linear variation was correct. Using the equation from the regression analysis, then Delta T at 10.17 kW can be calculated from:

$$\Delta T = 1.9487(\text{Actual Heat Load}) + 30.846 \text{ (from Figure 5.1)} \Rightarrow \Delta T_{10.17kW} = 51 \text{ °F}$$

Table 5.1

Palo Verde Nuclear Generating Station
NAC-UMS® Universal Storage System
First Cask Over 10 kW Temperature Data

Temperature Monitoring System (TMS) Data

Date	Time	Ambient (Inlet) [°F]	Outlet [°F]	ΔT [°F]*
5/19/2003	3:30 p.m.	103.6	142.15	37.74
5/19/2003	4:30 p.m.	103.2	147.29	43.82
5/19/2003	5:30 p.m.	102.4	141.73	40.45
5/19/2003	6:30 p.m.	101.6	144.90	42.72
5/19/2003	7:29 p.m.	96.1	150.43	54.29
5/19/2003	8:30 p.m.	93.9	144.51	50.17
5/19/2003	9:31 p.m.	89.1	141.95	51.93
5/19/2003	10:30 p.m.	86.3	142.08	55.79
5/19/2003	11:30 p.m.	80.1	140.62	61.11
5/20/2003	12:30 a.m.	76.3	133.67	57.33
5/20/2003	1:30 a.m.	73.8	131.62	57.39
5/20/2003	2:29 a.m.	70.7	140.62	69.92
5/20/2003	3:30 a.m.	71.9	139.15	67.98
5/20/2003	4:31 a.m.	69.7	136.11	66.49
5/20/2003	5:30 a.m.	69.9	139.05	68.94
5/20/2003	6:31 a.m.	71.3	139.16	68.19
5/20/2003	7:30 a.m.	75.9	140.18	64.66
5/20/2003	8:30 a.m.	80.9	141.42	59.88
5/20/2003	9:29 a.m.	87.2	145.32	58.24
5/20/2003	10:30 a.m.	93.7	147.33	54.46
5/20/2003	11:31 a.m.	99.8	148.80	49.20
5/20/2003	12:30 p.m.	102.1	139.72	38.04
5/20/2003	1:31 p.m.	103.3	138.46	35.47
5/20/2003	2:30 p.m.	105.1	140.09	35.28
5/20/2003	3:30 p.m.	105.1	139.93	35.60
AVERAGE		88.52	141.45	53.00

* NOTE: This column reflects the ΔT data that is reported by TMS. Minor differences between this value and the arithmetic difference between the reported values for outlet and ambient temperature are due to signal filtering.

Note: The data in this table was copied directly from the APS letter that transmitted the data to NAC International, Reference 7.6

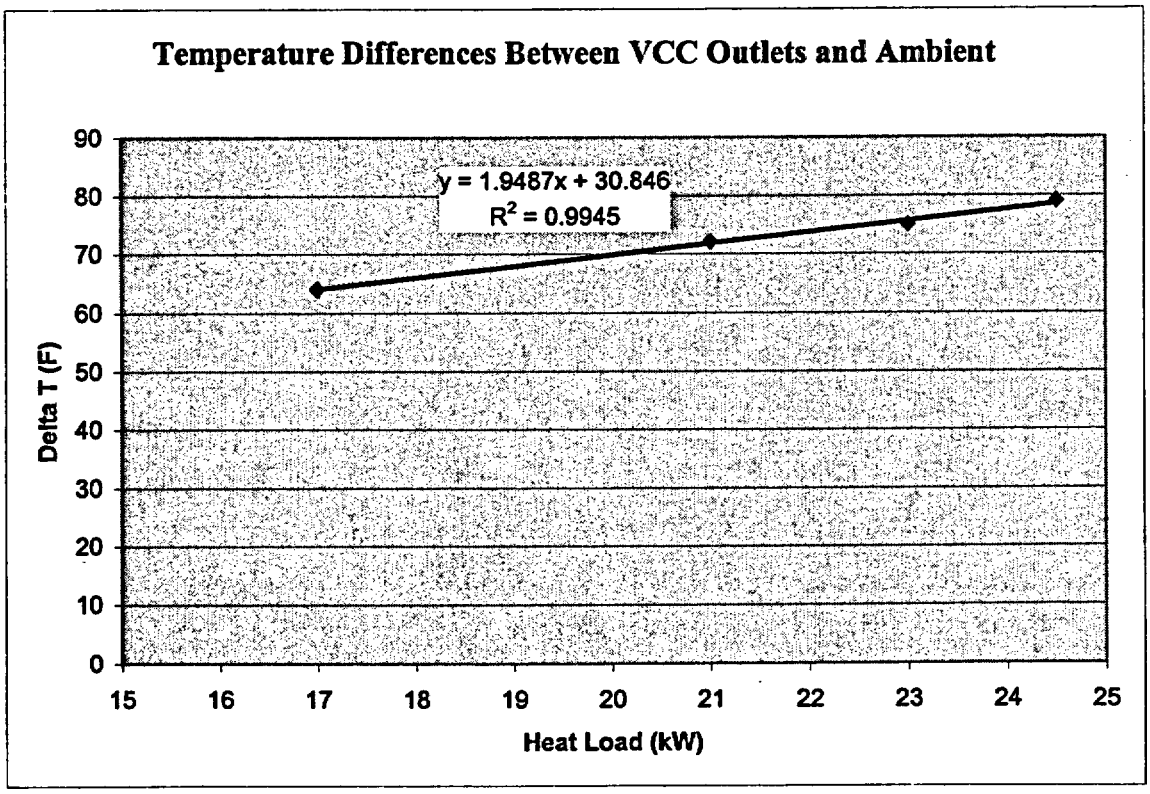
Table 5.2

Calculated Temperature Differences From Analysis

Heat Load (kW)	$\Delta T = T_{avg}$(outlet)- T_{avg}(inlet)	Reference
24.5	79	7.5
23	75	7.3
21	72	7.4
17	64	7.4

Figure 5.1

Linear Curve Fit of Calculated ΔT From Analysis versus Heat Load



6.0 Summary and Conclusions

In response to the Technical Specification requirements of the NAC-UMS® C of C, Reference 7.1, the heat transfer characteristics of the first NAC-UMS® System cask with a heat load over 10 kW have been measured and calculated. The calculated Delta T for 10.17 kW heat load of 51 °F is within 2 °F of the measured Delta T value of 53 °F. The difference between the measured Delta T and the calculated Delta T is within the range of variation determined by the thermal sensitivity study. Therefore, the thermal test data confirms the calculated heat transfer characteristics for the NAC-UMS® System.

The Technical Specification also sets an upper bound limit for the Delta T between the ambient and the average temperature of the outlets for a VCC containing PWR spent fuel of 102°F. As shown, the measured Delta T of 53 °F for 10.17 kW is well below this limit. Furthermore, the Delta T calculated from the thermal analysis for the design basis heat load of 23 kW is 75°F. Since the measured data verified that the heat transfer characteristics for the NAC-UMS® System are modeled correctly, the measured average Delta T at the design basis heat load of 23 kW would not exceed the Technical Specification limit of 102°F.

In conclusion, the measured temperature data demonstrates that the thermal models and analysis results reported for the NAC-UMS® System in the FSAR, Reference 7.2, correctly represents the heat transfer characteristics of the storage system.

7.0 References

7.1 Certificate of Compliance No. 1015 for the NAC International. Inc. UMS® Universal Storage System, Amendment 2, United States Nuclear Regulatory Commission (NRC), December 31, 2001.

7.2 Final Safety Analysis Report (FSAR) for the UMS® Universal Storage System, Amendment 2, NAC International, Inc. December 2001.

7.3 NAC International Calculation, EA790-3301, Rev. 2, UMS® VCC Air Flow and Temperature Calculation.

7.4 NAC International Calculation, EA790-3310, Rev. 4, Fuel Temperature versus Heat Load.

7.5 NAC International Calculation, EA790-3301, Rev. 1, UMS® VCC Air Flow and Temperature Calculation.

7.6 APS letter, 497-00123-BJH, from Brian J. Hansen, APS to Norman Eng, NAC International dated May 28, 2003.