



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT □ P. O. Box 15830, Sacramento CA 95852-1830, (916) 452-3211
AN ELECTRIC SYSTEM SERVING THE HEART OF CALIFORNIA

NQA 99-128

November 1, 1999

U.S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, DC 20555

Docket No. 72-11
Rancho Seco Independent Spent Fuel Storage Installation
HSM Surface Dose Rate Shielding Benchmarks

Attention: Randy Hall

As we discussed, I am forwarding a copy of the letter I received from Kyle Jones of Transnuclear West (TNW) discussing measured dose rate information for horizontal storage modules (HSMs) at Davis-Besse and Oconee. The letter and its attachments include radiological surveys and measured data for the first two HSMs loaded at Davis-Besse and the first two standardized HSMs loaded at Oconee.

The standardized HSMs used at Davis-Besse and Oconee are identical to those at Rancho Seco. In addition, both Davis-Besse and Oconee have the same fuel assembly design as Rancho Seco (B&W 15 x 15). Based on the measured results, TNW has concluded that their HSM shielding calculations provide reasonable predictions of the HSM dose rates on the front face of the HSMs and extremely conservative predictions of the HSM roof dose rates.

If you, or members of your staff, have questions requiring additional information or clarification, please contact Bob Jones at (916) 732-4843.

Sincerely,

Jerry Delezenski
Superintendent, Quality/Licensing/Administration

NFD/6

Cc: E.W. Merschoff, NRC, Region IV, Arlington



October 26, 1999
2069-99-780

FAXED
10/27/99

Bob Jones
Sacramento Municipal Utility District
Rancho Seco Nuclear Generating Station
14440 Twin Cities Rd.
Herald, California 95638

Reference: SMUD/NRC/SAIC/TNW Teleconference on October 26, 1999

Subject: HSM Surface Dose Rate Shielding Benchmarks

Dear Mr. Jones:

During today's teleconference, I committed to provide measured dose rate information for standardized NUHOMS[®] Horizontal Storage Modules (HSMs) located at the Davis-Besse Nuclear Power Plant. Radiological surveys for the first two Davis-Besse HSMs are attached to this letter, and include the measured door dose rates as requested. I have also obtained some measured dose rates from the first two standardized HSMs located at the Oconee Nuclear Station. All of this data is for HSMs that are identical to those at Rancho Seco, and for the same fuel assembly design (B&W15x15). A summary of the measured data, fuel parameters, and analytical predictions is provided below for your information. You are welcome to provide this information to the NRC to support Rancho Seco's ISFSI license application.

Table 1 summarizes the measured dose rates on the surface of Davis-Besse HSM 1. The fuel in this HSM has an average burnup of 24,545 MWd/MTU, an initial enrichment of 2.63 w/o U-235, and a cooling time of 13 years. Calculated dose rates were estimated using the peak centerline and vent dose rates from calculation NUH004.0509. These dose rates were multiplied by the ratio of the as-loaded source term to the design basis (40,000 MWd/MTU, 4.0 w/o U-235, 5-year) source term to account for the actual fuel irradiation history. Source terms for this estimate were obtained using the OCRWM Characteristics Database. Similar information for Davis-Besse HSM 2, Oconee HSM 41, and Oconee HSM 42 is provided in Tables 2 through 4.

Transnuclear West Inc.
39300 Civic Center Drive, Suite 280, Fremont, CA 94538
Phone: 510-795-9800 • Fax: 510-744-6002

Table 1
 Measured Dose Rates for Davis-Besse HSM 1
 (24,545 MWd/MTU, 2.63 w/o U-235, 13 years)

	Measured			Calculated		
	Gamma (mrem/hr)	Neutron (mrem/hr)	Total (mrem/hr)	Gamma (mrem/hr)	Neutron (mrem/hr)	Total (mrem/hr)
HSM Roof						
Centerline	<1	<1	--	9.4	0.015	9.4
Vent	60.0	<1	60.0	260.4	0.18	260.6
HSM Front						
Door	7.0	1.2	8.2	6.7	0.48	7.2
Vent	22.0	<1	22.0	34.6	0.038	34.6

Table 2
 Measured Dose Rates for Davis-Besse HSM 2
 (27,473 MWd/MTU, 2.80 w/o U-235, 13 years)

	Measured			Calculated		
	Gamma (mrem/hr)	Neutron (mrem/hr)	Total (mrem/hr)	Gamma (mrem/hr)	Neutron (mrem/hr)	Total (mrem/hr)
HSM Roof						
Centerline	<1	<1	n/a	10.5	0.022	10.5
Vent	90.0	<1	90.0	290.9	0.26	291.1
HSM Front						
Door	7.0	1.2	8.2	7.5	0.69	8.2
Vent	35.0	<1	35.0	38.6	0.054	38.7

Note: Vent dose rates include contributions from adjacent HSM 1

Table 3
 Measured Dose Rates for Oconee HSM 41
 (35,213 MWd/MTU, 3.29 w/o U-235, 13 years)

	Measured			Calculated		
	Gamma (mrem/hr)	Neutron (mrem/hr)	Total (mrem/hr)	Gamma (mrem/hr)	Neutron (mrem/hr)	Total (mrem/hr)
HSM Roof						
Centerline	n/a	n/a	n/a	13.4	0.048	13.5
Vent	70.0	0.20	70.2	371.0	0.58	371.5
HSM Front						
Door	8.0	0.20	8.2	9.5	1.5	11.1
Vent	18.0	0.30	18.3	49.3	0.12	49.4

Notes: (1) n/a indicates that the information is not available
 (2) Minimum assembly burnup is 30,206 MWd/MTU and the maximum is

37,691 MWd/MTU. Average burnup is 35,213 MWd/MTU and was used to estimate the source terms.

Table 4
 Measured Dose Rates for Oconee HSM 42
 (37,757 MWd/MTU, 3.31 w/o U-235, 11 years)

	Measured			Calculated		
	Gamma (mrem/hr)	Neutron (mrem/hr)	Total (mrem/hr)	Gamma (mrem/hr)	Neutron (mrem/hr)	Total (mrem/hr)
HSM Roof						
Centerline	n/a	n/a	n/a	15.6	0.073	15.7
Vent	130.0	n/a	130.0	803.0	1.44	804.4
HSM Front						
Door	10.0	n/a	10.0	11.1	2.30	13.4
Vent	35.0	n/a	35.0	106.7	0.30	107.0

- Notes: (1) n/a indicates that the information is not available
 (2) Minimum assembly burnup is 36,060 MWd/MTU and the maximum is 38,897 MWd/MTU. Average burnup is 37,757 MWd/MTU and was used to estimate the source terms.
 (3) Vent dose rates include contributions from adjacent HSM 41

With the exception of the door dose rate for Davis-Besse HSM 1, all of the measured dose rates are bounded by the analytical estimates, even when accounting for the actual fuel source terms. The estimated gamma dose rate on the door of Davis-Besse HSM 1 is within 5% of the measurement which is well within the uncertainty of the measurements and of this relatively crude estimation.

It should be noted that the roof dose rates (along the assembly sides) are overpredicted by a significantly greater degree than are the door/front dose rates (adjacent to the bottom end of the assemblies). This result is consistent with other spent fuel benchmarks as documented in EPRI TR-104329, "Evaluation of Shielding Analysis Methods in Spent Fuel Cask Environments."

Based on the results shown in Tables 1 through 4, I've concluded that TN West calculation NUH004.0509 provides reasonable predictions of the HSM dose rates on the front face and extremely conservative predictions of the dose rates on the HSM roof. These predictions were obtained using simple ratios of the neutron and gamma source terms. Because the surface dose rates used to calculate offsite exposures in the Rancho Seco ISFSI SAR (refer to calculation 2069.0502) were calculated in the same manner, they should be conservative as well.

Bob Jones
Sacramento Municipal Utility District

2069-99-780
October 26, 1999

Please contact me at (510) 744-6026 if you have any questions or would like additional information.

Sincerely,

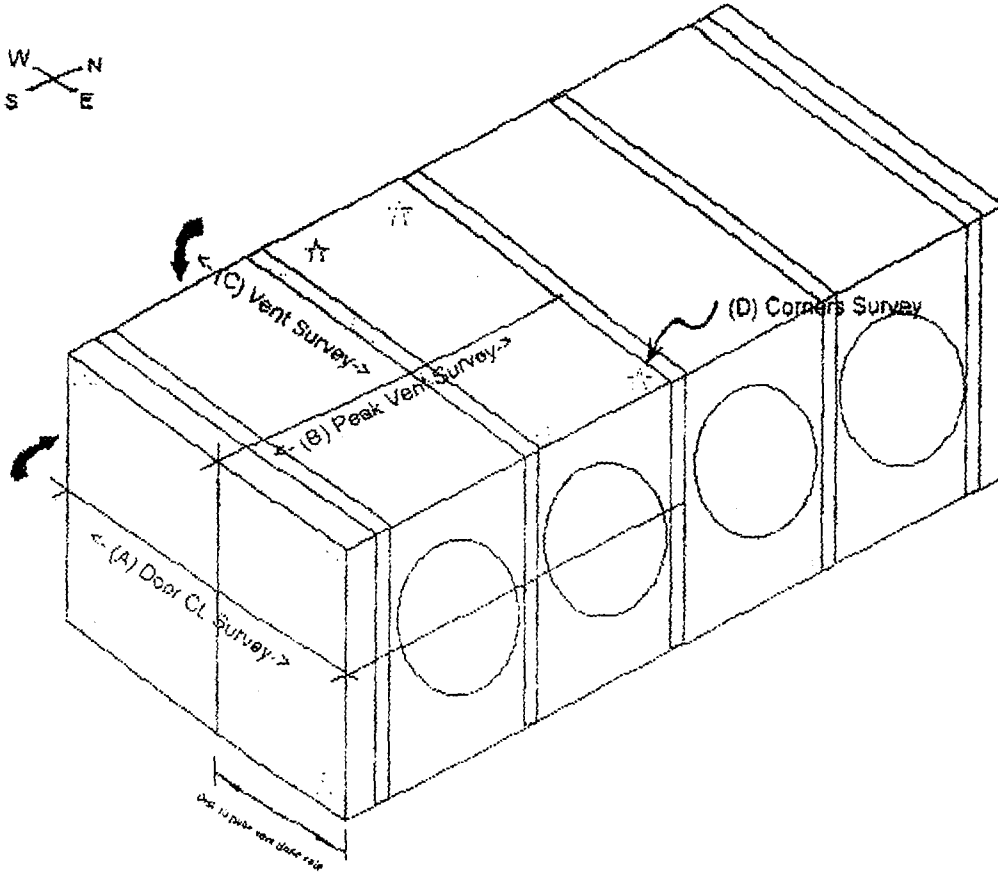


Kyle B. Jones, P.E.
Project Manager

Enclosure: Davis-Besse Radiological Survey (5 pages)

cc: File 2069.0003
J. K. Boshoven

Davis-Besse Dry Fuel Storage Project Radiological Survey Data



MOORE
 Data taken by McCracken/Snee ; Lowry/Hyman Date 1-11-96

Equipment & S/N	<u>2000W</u>	<u>2.7.248</u>	<u>cal due</u>	<u>2-4-96</u>	<u>2000W</u>	<u>2.7.331</u>	<u>cal due</u>	<u>2-11-96</u>
	<u>ASPI</u>	<u>2.7.229</u>	<u>" "</u>	<u>3-26-96</u>	<u>ASPI-1</u>	<u>2.7.229</u>	<u>cal due</u>	<u>3-26-96</u>

Davis-Besse Dry Fuel Storage Project Radiological Survey Data

(A) Door CL Survey			
Take measurements at door centerline height			
Location	Dose Rate (mrem/hr)		Notes
	neutron	gamma	
Front wall- 0/1 vent	<1	20?	
Front wall- left side of door #1	<1	1	
Front wall- center of door #1	1.2	7	
Front wall- right side of door #1	<1	1.5	
Front wall- 1/2 vent	<1	35	
Front wall- left side of door #2	<1	1.5	
Front wall- center of door #2	1.2	7	
Front wall- right side of door #2	<1	1	
Front wall- 2/3 vent	<1	35	
End wall - 3 ft. from SW corner	<1	<1	
End wall - 6 ft. from SW corner	<1	<1	
End wall - 9 ft. from SW corner	<1	<1	
End wall - 12 ft. from SW corner	<1	<1	
End wall - 15 ft. from SW corner	<1	<1	
End wall - peak (note location)	<1	<1	
Rear wall - 3 ft. from SW corner	<1	<1	
Rear wall - 6 ft. from SW corner	<1	<1	
Rear wall - 9 ft. from SW corner	<1	<1	
Rear wall - 12 ft. from SW corner	<1	<1	
Rear wall - 15 ft. from SW corner	<1	<1	
Rear wall - 18 ft. from SW corner	<1	<1	
Rear wall - 21 ft. from SW corner	<1	<1	
Rear wall - 24 ft. from SW corner	<1	<1	
Rear wall - peak (note location)	<1	<1	

Davis-Besse Dry Fuel Storage Project
Radiological Survey Data

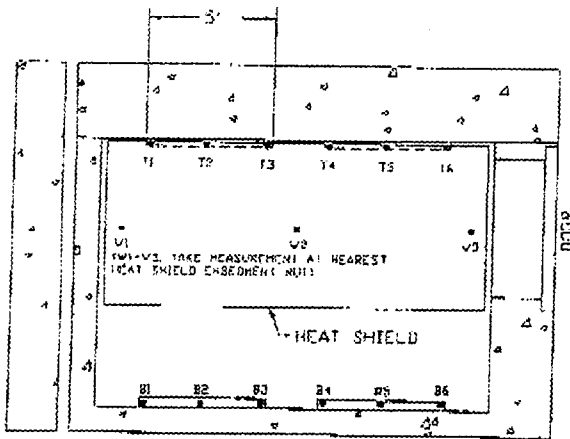
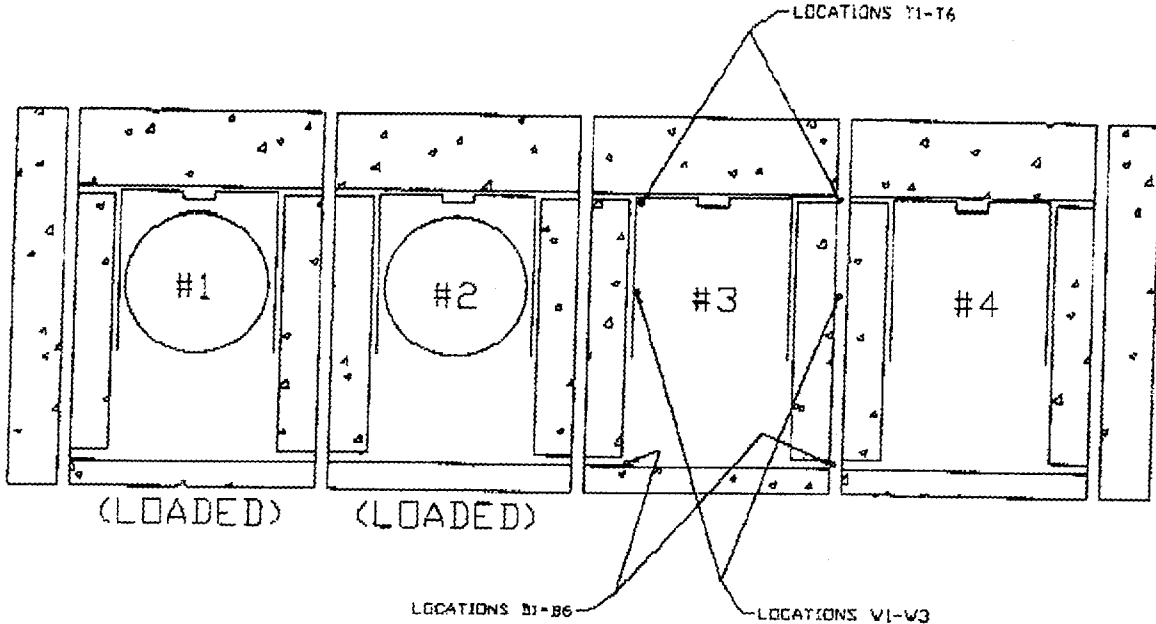
(B) Peak Vent Survey			
Take measurements at distance* to peak roof vent dose rate.			
Location	Dose Rate (mrem/hr)		Notes
	neutron	gamma	
*Note dist. from HSM front to peak->	x	x	
End wall - 3 ft. from ground	< 1	< 1	
End wall - 6 ft. from ground		< 1	
End wall - 9 ft. from ground		< 1	
End wall - 12 ft. from ground		< 1	
0/1 vent- 24" south of vent centerline			
0/1 vent- 18" south of vent centerline			
0/1 vent- 12" south of vent centerline			
0/1 vent- 6" south of vent centerline			
0/1 vent- at vent centerline		60	
0/1 vent- 6" north of vent centerline			
0/1 vent- 12" north of vent centerline			
0/1 vent- 18" north of vent centerline			
0/1 vent- 24" north of vent centerline			
HSM #1- 36" north of south edge			
HSM #1- 58" north of south edge			
HSM #1- 80" north of south edge			
1/2 vent- 24" south of vent centerline			
1/2 vent- 18" south of vent centerline			
1/2 vent- 12" south of vent centerline			
1/2 vent- 6" south of vent centerline			
1/2 vent- at vent centerline		80	
1/2 vent- 6" north of vent centerline			
1/2 vent- 12" north of vent centerline			
1/2 vent- 18" north of vent centerline			
1/2 vent- 24" north of vent centerline			
HSM #2- 36" north of south edge			
HSM #2- 58" north of south edge			
HSM #2- 80" north of south edge			
End wall- peak near top			note loc'n-
End wall- peak near bottom	✓		note loc'n-

**Davis-Besse Dry Fuel Storage Project
Radiological Survey Data**

(C) Vent Survey			
Take measurements along vent centerline			
Location	Dose Rate (mrem/hr)		Notes
	neutron	gamma	
Front wall- 3 ft. from ground	<1	20	
Front wall- 6' from ground	<1	20	
Front wall- 9' from ground	<1	35	
Front wall- 12' from ground	<1	35	
Front wall- 15' from ground	<1	25	
Front wall- peak	<1	35	note loc'n-
Roof- 3 ft. from front	<1	50	
Roof- 6 ft. from front	<1	80	
Roof- 9 ft. from front	<1	90	
Roof- 12 ft. from front	<1	85	
Roof- 15 ft. from front	<1	70	
Roof- 18 ft. from front	<1	30	
Roof- peak	<1	80	note loc'n-
Rear wall- 3 ft. from ground	<1	<1	note loc'n- 1/2 vent
Rear wall- 6' from ground	<1	<1	
Rear wall- 9' from ground	<1	<1	
Rear wall- 12' from ground	<1	<1	
Rear wall- 15' from ground	<1	<1	
Rear wall- peak	<1	<1	note loc'n-

(D) Corners Survey			
Take measurements 2 ft. in in both directions from corner.			
Location	Dose Rate (mrem/hr)		Notes
	neutron	gamma	
HSM#2 roof- NW corner	<1	<1	
HSM#2 roof- NE corner	<1	<1	
HSM#2 roof- SW corner	<1	<1	
HSM#2 roof- SE corner	<1	<1	
End wall- top left corner	<1	<1	
End wall- top right corner	<1	<1	
End wall- bottom left corner	<1	<1	
End wall- bottom right corner	<1	<1	

Davis-Besse Dry Fuel Storage Project Radiological Survey Data



	Dose Rate (mrem/hr)			
	HSM interior		HSM alley	
	neut	gamma	neut	gamma
T1				
T2				
T3				
T4		900		
T5				
T6				
W1				
W2		300		
W3		20		
B1				
B2				
B3				
B4				
B5				
B6				
General open doorway				

Data taken by Jaegle - D. S. / M. S. Date 1-18-96
 Equipment & S/N _____