Babcock & Wilcox

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NNFD RESEARCH LABORATORY

P.O. Box 11165
Lynchburg, VA 24506-1165
(804) 522-6000

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U.S. Nuclear Regulatory Commission
Attn: Stewart Ebneter, Regional Administrator
101 Marietta ST., N.W.
Atlanta GA 30323

Gentlemen:

The Babcock & Wilcox Company, Naval Nuclear Fuel Division Research Laboratory (NNFD-RL), is providing the attached information as requested by William E. Cline of your staff.

The attached information addressees our recent concerns about the adequacy of criticality monitoring equipment for our hot cell operations and the subsequent actions taken. Hopefully this information may be of assistance to you and other organizations.

If you should have any further questions, please feel free to contact me at (804) 522-5753.

Sincerely,

Charlie C. Boyd, Jr.

Charlie C. Boyd, Jr.
Licensing Administrator

Attachments

Attachment 1

HOT CELL SITUATION SUMMARY

In 1988 NNFD-RL conducted a review of the criticality monitor placements throughout the facility. This review led to questions concerning the coverage of such monitors at the four hot cell locations.

As a result of this concern, calculations were performed using assumptions from Reference 3 (references listed in Attachment 4) to verify the current coverage and in late January, 1989 the preliminary results indicated that a criticality in Hot Cells Nos. 2, 3, and 4 could result in injury to personnel from the neutron radiation generated.

The construction of Hot Cells Nos. 2, 3, and 4 (given in Table 1 of Attachment 3) provides sufficient shielding of gamma radiation to prevent our current gamma sensitive criticality monitors from alarming in the event of an accident. The shielding for these three cells however would not prevent personnel injury in the case of the neutron radiation from a criticality. Table 2 in Attachment 3 provides a comparison between the gamma and neutron radiation shielding for the four hot cells. Hot Cell No. 1 has sufficient shielding to prevent gamma and neutron radiation from causing any significant exposure or being detected by monitors.

Based on this information, even though we operate with maximum sized units of 350 grams U-235 (which is safe double batched, under any H/X conditions), SNM operations in Hot Cells No. 2, 3, and 4 were discontinued until some alternative form of monitoring could be put in place. Hot Cell No. 1 was allowed to continue operations while an exemption from the monitoring requirements of 10 CFR 70.24 was sought since there is no danger to personnel or the environment. Attachment 2 discusses the rationale behind the exemption request in more detail.

Calculations were started to verify the preliminary findings. On February 9, 1989 the final calculations were ready which confirmed the preliminary results. Based on these results on February 10, 1989, four NMC Model NM-6 neutron monitors were requested to be purchased. The instruments were ordered from:

Nuclear Measurements Corp.
P.O. Box 18248
Indianapolis, Indiana 46218-0248
(317) 546-2415

In the interim, ORNL agreed on February 21, 1989 to provide us temporary use of two, Model Q2562, criticality monitors which would respond to neutron radiation. The monitors were picked up on March 2, 1989 and temporarily installed outside of Hot Cell No. 2. The monitors were calibrated and tested and Hot Cell No. 2 placed back into operation on March 8, 1989.

Our order for the four monitors should be filled and shipped on June 2, 1989. Hot Cells Nos. 3 and 4 will continue to be shut down for SNM operations until the new monitors are installed, calibrated, and tested.

Attachment 2

The following are the reasons for the request of an exemption from the criticality monitoring requirements of 10 CFR 70.24 for Hot Cell No. 1.

The event used by NNFD-RL for our calculations of dose is based on a burst of 1E18 fissions. The requirements for our criticality monitoring system were based on 10 CFR 70.24 which requires that a monitoring system must be able to respond to an excursion causing a dose of 20 Rads accumulating within 60 seconds at an unshielded distance of 2 meters.

Using Appendix B of Reference 2, we determined that a gamma sensitive detector located outside of Hot Cell No. 1 would not respond to the minimum excursion as required by the regulations. In the event that a criticality occurred in Hot Cell No. 1, it would be detected within less than a minute when the off-gas from the cell's ventilation system passed the stack monitors.

Using standard gamma attenuation techniques in conjunction with XSDRN calculations to determine neutron attenuation we determined that a 1E18 fission burst would result in a gamma plus neutron dose outside the cell of only 0.006 Rem. The gamma attenuation calculation used a prompt gamma fission spectrum from Reference 5. With such a low dose rate, 0.006 Rem, the monitors would not detect a criticality if one were to occur. Also, a total dose of 0.006 Rem does not pose a significant hazard to anyone who would be working next to the cell.

The situation with Hot Cell No. 1 is essentially the same as the one presented in 10 CFR 70.24 (a) for SNM handled or stored underwater which also does not require monitoring.

If a detector was located within the cell it would present calibration and maintenance problems and would increase the present rate of entries into the cell, compromising ALARA principles. Therefore, there is no viable method of monitoring Hot Cell No. 1 for a criticality accident.

Attachment 3

TABLE 1

CELL CONSTRUCTION

CELL	WALL MATERIAL	WALL THICKNESS (Inches)
1	Ilmenite concrete (240 lbs/cu.ft.)	42
2	lead shot	13
3	lead shot	11
4	Ferrophrosphous concrete & lead shot	14

TABLE 2

SHIELDING FACTORS

CELL	NEUTRON SHIELDING FACTOR	GAMMA SHIELDING FACTOR
1	3.9E7	6.0E5
2	*7.6	6.3E5
3	7.6	1.5E5
4	1.5E2	*6.0E5

* Numbers are close approximations but not calculated.

Attachment 4

LIST OF MAJOR REFERENCES

Reference 1 "Criticality Accident Alarm Systems," U.S. NRC Regulatory Guide 8.12 Revision 1, dated January 1981

Reference 2 "Criticality Accident Alarm Systems," ANSI/ANS-8.3 1979

Reference 3 "Assumptions Used For Evaluating The Potential Consequences Of Accidental Nuclear Criticality In A Uranium Fuel Fabrication Plant," U.S. NRC Regulatory Guide 3.34 Revision 1, dated July 1979

Reference 4 "Radiological Contingency Plan (RCP), Naval Nuclear Fuel Division Research Laboratory," License SNM-778, dated June 1987

Reference 5 "Reactor Shielding Design Manual," by Teodore Rockwell, III, dated 1956.