

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 70-1308/81-02

Docket No. 70-1308

License No. SNM-1265

Licensee: General Electric Company
175 Curtner Avenue
San Jose, CA 95125

Facility Name: Morris Operation

Inspection At: Morris Operation, Morris, IL

Inspection Conducted: May 31 and June 5-7, 1981

D. E. Miller/for
Inspector: C. C. Peck

7-16-81

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Approved By: L. R. Greger, Acting Chief
Facilities Radiation
Protection Section

7-16-81

Inspection Summary:

Inspection on May 31 and June 5-7, 1981 (Report No. 70-1308/81-02)

Areas Inspected: Special, announced inspection of high levels of removable radioactivity measured on the external surface of a spent fuel cask after trips between the licensee's facility and Genoa, Wisconsin. The inspection required 22 inspector-hours onsite by one NRC inspector.

Results: No items of noncompliance were identified.

DETAILS

1. Persons Contacted

- *E. E. Voiland, Plant Manager
- *K. J. Eger, Senior Engineer, Licensing and Radiological Safety
- T. E. Tehan, Senior Engineer, Field Services
- K. A. Astrom, Field Services Specialist

A number of other supervisors, safety technicians, and operating technicians were interviewed. In addition, representatives of the Dairyland Power Cooperative provided information and data to the inspector.

*Denotes those present at the exit meeting.

2. General

The inspection began at 3:30 p.m. on Sunday, May 31 and was continued on June 5-7, 1981. The purpose of the inspection was to observe activities associated with a series of spent fuel shipments from Morris Operation to the LaCrosse Boiling Water Reactor (LACBWR) at Genoa, Wisconsin. Of special interest and concern were the high levels of removable radioactive material detected on the surface of the spent fuel cask after three of the seven trips between the two facilities. While contamination levels above the DOT limit of 22,000 dpm/100 cm² are not acceptable, such levels do not present a hazard to public health and safety because the cask is enclosed in a metal cage and is therefore inaccessible.

3. Background

The NAC-1D spent fuel cask is one of a group of identical casks licensed by NRC Certificate of Compliance No. 6698. The official model number or cask name is NFS-4. NAC-1D, the only cask of the NFS-4 group currently in service, has been used for several years to transport spent fuel from reactors to research and fuel storage facilities. The cask has a smooth stainless steel surface and relatively few surface irregularities where radioactive material can lodge to make decontamination difficult after the cask is removed from a fuel storage pool.

The inspector knows of no significant problems of excessive removable radioactivity associated with the NAC-1D cask or with any of the other NFS-4 cas's before 1981. There have been occasional reports by licensees, as required by 10 CFR 20.205(b)(2), of localized areas exceeding the DOT limit. There were at least two such reports in 1980 while the cask was in use in Region III.

In 1980, the NAC-1D and NAC-1E casks were used alternately in a series of fuel transfers from the San Onofre Nuclear Generating Station in California to Morris. While there was only one report of removable surface contamination exceeding the DOT limit, survey data show that removable contamination on the NAC-1D cask was significantly higher than that on the 1E cask at the conclusion of several of the eastbound² trips. Contamination levels were generally less than 2,200 dpm/100 cm² when the casks left California.

When the fuel shipments from California were concluded, the NAC-1D cask was decontaminated to less than 2,200 dpm/100 cm² by Morris Operation, then placed in outside storage for about six weeks. Smear surveys made in preparation for transferring the empty cask offsite disclosed a general increase in removable contamination to an average of about 5,000 dpm/100 cm². The cask was again decontaminated to less than 2,200 dpm/100 cm² and released for use by other licensees.

In February 1981, the existence of removable contamination well above the DOT limit was reported to NRC on receipt of NAC-1D at the Oyster Creek Nuclear Station. Before releasing the cask from Oyster Creek, a removable coating was applied to the stainless steel surface, apparently as a precaution to prevent an increase in removable contamination during transport. Surface contamination levels were well within the DOT limit when the cask arrived at Battelle Columbus Laboratories, where the cask remained for several weeks. The licensee applied a removable coating before immersing the cask in the storage pool to facilitate decontamination and avoid possible problems with meeting the DOT limit. The licensee reported that a tendency for removable contamination levels to increase with time was observed during its several weeks at Battelle. After a final decontamination, the cask was transferred to Morris Operation for use in transporting spent fuel to LACBWR. According to licensee personnel, no surface contamination problems were encountered during this trip.

Attachment A is a tabulation of surface contamination measured on casks NAC-1D and NAC-1E during the series of fuel shipments from San Onofre to the licensee in 1980. While not in use, cask 1D was stored at the licensee's facility. Late in the year, the cask was transferred to Duke Power Company. Cask 1E was transferred to the Connecticut Yankee Nuclear Station in April 1980 and was not used again in the San Onofre fuel shipments.

4. Removable Contamination During Fuel Shipments to LACBWR

The NAC-1D cask was used to transport eight fuel assemblies from Morris to LACBWR, two assemblies at a time. Seven trips between the two facilities were required after which the empty cask was shipped to Battelle Columbus Laboratories for other use. The purpose of the shipments was to return to LACBWR the eight assemblies which were sent to Morris Operation in 1979 for temporary storage to provide needed space at LACBWR for reracking of the fuel storage pool.

Attachment B is a tabulation of removable contamination measured on the cask surface after each of the seven trips. As indicated, no levels above the DOT limit of 22,000 dpm/100 cm² were detected after the first two trips, although contamination measured by the receiver generally exceeded that measured by the shipper. This was not considered unusual based on experience with the cask during 1980.

LACBWR reported removable contamination above the DOT limit at the conclusion of the third shipment. The maximum level of 380,000 dpm/100 cm² and an average of about 80,000 dpm/100 cm² exceeded levels previously reported to Region III for any spent fuel cask. The receiver stated that decontamination procedures would be exceptionally thorough and would include the use of additional decontamination agents acetone and an ammonia solution. These measures appeared successful in reducing the high contamination levels, and the empty cask was returned to Morris.

Despite the extensive decontamination efforts, removable contamination again exceeded the DOT limit after the fourth trip. The licensee, after decontaminating the cask surface to less than 1000 dpm/100 cm², subjected the cask to a simulated rainstorm and had the loaded cask onsite for a period corresponding to the transport time between Morris and LACBWR at the request of Region III. When no increase in removable contamination was detected after eight hours, the cask was allowed to proceed to LACBWR.

When removable contamination levels after the fourth shipment were found to exceed those previously encountered, Region III issued an Immediate Action Letter (IAL) to Dairyland Power Cooperative to ensure that the cask remain onsite at LACBWR until positive actions could be taken that would ensure that the DOT limit would not again be exceeded. The removable contamination levels seemed to be affected by moisture, time, and road vibration. In response to the IAL, a temporary amendment to the cask certificate was obtained permitting the cask to be covered with plastic. After decontamination to less than the DOT limit, a cover of reinforced polyethylene plastic was fitted over the entire cask surface. As an additional precaution Dairyland agreed to provide a chase vehicle equipped with radiation monitoring equipment and materials to make any necessary repairs to the plastic cover during the trip. The plastic remained intact during the sixth trip, and no removable contamination was detected on the outer surface of the plastic at Morris. Contamination levels on the cask surface under the plastic were generally less than 22,000 dpm/100 cm², although they were higher than the levels measured before shipment. Contamination in a small area exceeded 22,000 dpm/100 cm² apparently because a small amount of contaminated water trapped in a drain port leaked to the surface during transit.

The cask was again covered with plastic for the final fuel shipment to LACBWR. There was no radioactivity on the plastic at the conclusion of the trip. Contamination levels beneath the plastic were within the limit but slightly above those measured before shipment.

5. Cause of Removable Contamination

The licensees involved in the fuel shipments from Morris to LACBWR provided the inspector with measurement data and information that they accumulated in their efforts to quantify and determine the cause of the removable contamination.

Morris Operation has used casks of the NFS-4 type, including the NAC-1D cask, for several years with no removable contamination problems. The casks have a smooth stainless steel surface which make them relatively easy to decontaminate compared to other types of casks that have been used in the past. Water solutions of a mild detergent, such as trisodium phosphate, had been sufficient to reduce removable contamination levels to less than 22,000 dpm/100 cm² and to maintain the level at less than the 22,000 dpm/100 cm² DOT limit in subsequent transport. The use of wire brushes and vigorous scrubbing had not been necessary.

The substantial increases in the removable contamination levels on the surface of the NAC-1D cask in late 1980 could indicate a change in the stainless steel cask surface, making removal of radioactive material adhering to the surface more difficult (See Attachment A). A report in February 1981 of several areas exceeding 80,000 dpm/100 cm² detected on receipt of the cask, and a subsequent report that removable contamination tended to increase with time after decontamination, appear to indicate that normal decontamination procedures could no longer reliably control contamination levels within the DOT limit. However, the cask was subsequently transported to Morris Operation and then made two trips between Morris and LACBWR without exceeding the limit. Explanations for this inconsistent behavior have not been found.

After gamma high levels of removable contamination were detected following the third trip between Morris and LACBWR, the licensees made measurements to identify and quantify the surface contamination. Gamma isotopic measurements of the removable contamination disclosed that over 98 percent of the contamination was cesium-134 and cesium-137, with the remainder cobalt-60. Cesiums and cobalt are the principal radionuclides present in spent fuel pool water. In most pools, however, cesiums and cobalt are present in about equal concentrations.

The licensee made many measurements of the beta activity at the surface of the cask using hand-held ion chamber instruments. Beta activity measurements appear to be proportional to the total quantity of contamination on the cask surface, both removable and fixed. On arrival of the third fuel shipment at LACBWR, the shipment disclosing the highest removable contamination levels, the receiver reported beta activity levels in the cask surface averaging 400-500 mrad/hr. This was conservatively estimated to represent about 6E6 dpm/100 cm² of total fixed and removable activity. Following three decontamination efforts using solutions of potassium permanganate-potassium hydroxide and ammonium citrate oxalic acid, the beta level was reduced to about 40-100 mrad/hr.

Although this represents a fivefold to tenfold reduction in total surface activity, the amount remaining would appear sufficient to exceed the DOT limit if all the fixed contamination were converted to removable contamination.

6. Exit Interview

The inspector discussed the removable contamination problem with licensee representatives identified in Section 1 at the conclusion of this inspection.

The licensee representatives said they believed the radioactivity on the cask surface to be an accumulation from various spent fuel pools. They did not know what causes this mostly fixed contamination to sometimes become removable.

The licensee agreed with the inspector that the cask surface may have been affected, perhaps by the use of strong chemicals, so that only strong chemicals are effective in decontamination. They pointed out, however, that mild detergent solutions had been effective in the past for decontaminating the NAC-1D and other casks. They said they would not want to use strong acids, potassium hydroxide-potassium permanganate solutions, caustic solutions, or other strong chemicals routinely because these solutions create a waste handling problem and are a personnel hazard.

Attachments:

1. Attachment A, Removable Contamination
on NAC Casks Arriving at Morris
2. Attachment B, Removable Contamination on
NAC-1D Cask During Fuel Transfers to LACBWR

Attachment .

Removable Contamination on NAC Casks Arriving at Morris - 1980

<u>Date</u>	<u>Cask</u>	<u>Maximum dpm/100 cm²</u>	<u>Average dpm/100 cm²</u>
1/21/80	1D	19,000	9,000
1/22/80	1E	<2,200	<1,000
1/29/80	1D	8,000	4,000
2/16/80	1E	<2,200	<1,000
2/18/80	1D	3,400	1,200
2/27/80	1E	<2,200	<1,000
2/27/80	1D	4,200	1,500
3/6/80	1E	<2,200	<1,000
3/8/80	1D	3,100	1,400
3/15/80	1E	3,000	1,100
3/16/80	1D	<2,200	<1,000
3/22/80	1E	7,000	2,000
3/24/80	1D	5,500	2,000
8/12/80	1D	35,000	10,000
8/25/80	1D	39,000	8,000
9/7/80	1D	21,000	7,000

Attachment B

Removable Contamination on NAC-1D Cask During Fuel Transfers to LACBWR

<u>Date</u>	<u>Maximum dpm/100 cm²</u>	<u>Average dpm/100 cm²</u>	
5/26/81	<2,200	<1,000	Depart Morris
5/27/81	8,200	3,400	Arrive LACBWR
5/28/81	<2,200	<1,000	Depart LACBWR
5/28/81	11,000	5,000	Arrive Morris
5/29/81	<2,200	<1,000	Depart Morris
5/29/81	380,000	80,000	Arrive LACBWR
5/30/81	<2,200	<1,000	Depart LACBWR
5/31/81	280,000	50,000	Arrive Morris
6/2/81	<2,200	<1,000	Depart Morris
6/2/81	2,200,000	1,000,000	Arrive LACBWR
6/5/81	*Zero (<2,200)	*Zero (<1,000)	Depart LACBWR
6/5/81	*Zero (31,000)	*Zero (5,000)	Arrive Morris
6/7/81	*Zero (<2,200)	*Zero (<1,000)	Depart Morris
6/7/81	*Zero (7,000)	*Zero (2,000)	Arrive LACBWR

*Zero on surface of plastic cover.

Parenthetical Numbers are Contamination Under Cover.