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

REGION III

Reports No. 70-008/80-02; 30-5728/80-02; 50-6/80-01

Docket Nos. 70-08; 30-5728; 50-6 Licenses No. SNM-7; 34-06854; R-4

Licensee: Battelle Columbus Laboratories
505 King Avenue
Columbus, OH 43201

Facility Name: West Jefferson Nuclear Facility

Inspection At: Battelle Columbus Laboratories

Inspection Conducted: September 22-26 and November 12, 1980

Inspector: C. C. Peck C. C. Peck 11/25/80
Fuel Facility Inspector

Approved By: W. L. Fisher, Chief W. L. Fisher 11/25/80
Fuel Facility Projects and
Radiation Support Section

Inspection Summary

Inspection on September 22-26 and November 12, 1980 (Reports No. 70-008/80-02; 30-5728/80-02; 50-006/80-01)
Areas Inspected: Routine, unannounced health and safety inspection, including: operations review, training, transportation activities, technical specifications for the retired reactor facility, external exposure control, internal exposure control, and a followup inspection of a licensee report submitted pursuant to 10 CFR Part 21 describing a contamination incident.
Results: No items of noncompliance were identified in six of the seven areas inspected; two apparent items of noncompliance were identified in one area (infraction - overexposure of one individual to external radiation - paragraph 7f; deficiency - concentrations of radioactivity in fuel storage pool in excess of license limits - paragraph 7c).

DETAILS

1. Persons Contacted

*H. L. Toy, Licensing Coordinator
*D. A. McKown, Radiological Safety Officer
*W. J. Gallagher, Operations Manager, Hot Cell Laboratory
*H. M. Faust, Assistant Group Manager, West Jefferson Nuclear Services
*G. E. Kirsch, Health Physics Supervisor
T. R. Emsweiler, Transportation Supervisor
J. Wissinger, Plutonium Laboratory Health Physics Technician
E. R. Swindall, Hot Cell Laboratory Health Physics Technician

*Denotes those present at exit interview.

2. General

The inspection began at 8:30 a.m. on September 22, 1980, at the licensee's King Avenue office, where records of radiological safety meetings, case reviews by the Radiological Safety Committee, correspondence pertaining to NRC license SNM-7, and audits by the Radiological Safety Officer were examined. In addition records and correspondence related to the Hot Cell Laboratory contamination incident of May 3, 1980, and the employee overexposure of July 20, 1980, were studied and discussed with licensee representatives (paragraph 7).

On September 23-25, the inspector toured the Hot Cell Laboratory, Plutonium Laboratory, retired reactor facility, and radioactive waste storage areas at the West Jefferson Nuclear Facility. The tours were supplemented by discussions with WJNF site personnel.

The inspection was concluded at King Avenue on September 26, 1980.

3. Operations Review

a. Plutonium Laboratory

The program of decontaminating the laboratory to limits that will permit use of the facility for nonradiological work is continuing. Decontamination of a portion of the laboratory consisting of the metallography laboratory, the plutonium-238 laboratory, and the accountability office has been completed. Representatives of the Department of Energy have surveyed this portion of the laboratory, and the licensee is awaiting affirmation that the area is releasable. DOE, the lead agency in the administration and approval of the decontamination effort, has agreed that the survey records of both the licensee and DOE related to the decontamination will be available for NRC approval.

The inspector examined licensee survey procedures and records for the completed portion of the laboratory during the inspection. The licensee used ANSI Standard N13.12, "Control of Radioactive Surface Contamination on Material, Equipment, and Facilities to be Released for Uncontrolled Use," in decontamination, supplemented by quality assurance procedures. The QA procedures used for the post-decontamination monitoring of the facilities were examined. QA procedures Pu-DP-10.0 prescribes the method for the layout of a one-meter grid system on all wall, floor, and ceiling surfaces in preparation for surveys for radiation and removable contamination. QA procedure Pu-DP-10 prescribes instruments to be used in the survey and establishes acceptable release limits. The radiation limit is 220dpm/100cm^2, and the limit for removable contamination is 20 dpm/100cm^2. The inspector reviewed survey results for the decontaminated rooms. The records of more than 2500 smears indicated that all surface areas are within the limits. A few areas found on the initial survey to be contaminated in excess of the limits were recleaned.

The decontamination effort in the remainder of the laboratory is continuing. The same standards and procedures will be used in final contamination surveys.

b. Hot Cell Laboratory

In a tour of the Hot Cell Laboratory the inspector made the following observations:

- Posted fissile material inventories in the low level cell, high level cell, and high energy cell appeared up-to-date and totals corresponded with those on inventory cards.

- Housekeeping, both in the cells and in the work areas outside the cells, appeared to have deteriorated since the inspection in April 1980. There was an unnecessarily large number of tools, supply items, and items of protective clothing lying about. The manipulator repair area was particularly cluttered.

- Decontamination of the spent fuel pool area was stated to be virtually completed after the contamination incident of May 3, 1980 (Paragraph 7). Final contamination surveys and painting remain to be completed.

- Rules established by the Radiological Safety Committee for the safe handling of various types of spent fuels in the High Energy Cell were posted at the cell window as is customary. At the time of the inspection there were five sets of rules for five types of fuels currently being studied. This is an unusually large number. The licensee is considering standardizing the fuel handling parameters to the extent that this can be done without reducing criticality safety. Such a change would reduce the number of RSC cases and simplify fuel handling rules.

. The calibration status of criticality monitors, continuous air monitors, radiation instruments, and stack monitoring instruments was noted. Only one constant air monitor was overdue for calibration, according to the dated sticker on the instrument. However, the instrument section has stated that there is difficulty in timely completion of the monthly calibration schedule prepared by Quality Assurance and has asked for a priority list based on the relative safety significance of the various instruments.

No items of noncompliance were identified.

4. Transportation Activities

The inspector verified that Certificates of Compliance for the four licensee owned shielded shipping casks (BMI-1, BCL-2, BCL-3, and BCL-4) are current. The certificates require that the casks be inspected and tested periodically in accordance with criteria contained in the cask license applications. Completed procedures provided evidence that the most recent periodic inspections for the four casks were conducted as follows:

	Annual	Biennial
BMI-1	3/28/80	3/28/80
BCL-2	3/27/80	3/28/80
BCL-3	5/1/80	5/2/80
BCL-4	5/1/80	5/2/80

During tours of the retired reactor building (JN-3) and the Hot Cell Laboratory, the inspector observed radioactive waste packaged for shipment to burial. Waste from the Plutonium Laboratory decontamination program is packaged in drums and Argonne bins and stored in locked rooms in JN-3. Most of the stored packages contain plutonium from DOE-sponsored programs and are destined for disposal at government waste facilities. The remainder contain NRC-licensed material. Disposition of the licensed material is a problem, because no NRC-licensed burial sites presently can accept transuranic materials. Wastes generated in the Hot Cell Laboratory are stored in the new waste storage facility. Access to the storage room, a high radiation area, is restricted and the room is posted in accordance with regulatory requirements. Burial site license requirements also create a problem in disposition of some of the Hot Cell wastes.

Records of radioactive material shipments to and from the licensee were reviewed. Particular attention was paid to survey records.

No items of noncompliance were identified.

5. Training

The licensee maintains training records of employees at the West Jefferson Nuclear Facility. The records are updated monthly. Representative records were examined and found to be current.

The inspector noted that training sessions in the Hot Cell Operational Safety Manual (HL-A-1) had been conducted and supplemented by a written examination on safety in the Hot Cell Laboratory.

No items of noncompliance were identified.

6. Retired Reactor Facility

Compliance with Amendment No. 13 to the operating license, R-4, for the retired research reactor was inspected. Findings are itemized below.

Specification

2.1 . Activity levels in the water discharged from the basement sump have not exceeded the limits of 10 CFR Part 20.

3.1 . Records disclosed that the water monitor is calibrated and a channel test performed weekly.

3.2a . Quarterly radiation surveys are performed and documented as required.

3.2c . Physical barriers preventing access to the reactor are inspected quarterly.

5.5.1 . Annual reports have been sent to the NRC as required. These describe radiation survey results, facility status, and security and surveillance measures.

No items of noncompliance were identified.

7. Followup Inspection - Part 21 Report

a. The licensee submitted a report pursuant to 10 CFR Part 21, Reporting of Defects and Noncompliance, on June 27, 1980. The report described an incident of May 3, 1980, which the licensee subsequently concluded could have created a substantial safety hazard. The incident was the release of radioactive material when a spent fuel cask containing a failed fuel assembly was opened in the licensee's spent fuel pool. Part of the inspection was devoted to obtaining detailed information related to the incident and in particular to determine whether corrective actions proposed by the licensee have been implemented.

b. The sequence of events comprising the incident is presented below. The information was obtained from the Part 21 report, licensee records, and discussions with licensee representatives.

(1) An NFS-4 type spent fuel shipping cask, specifically identified as NAC-1E, departed the Connecticut Yankee Atomic Power Company facility on May 1, 1980. The shipment arrived at the West Jefferson Nuclear Facility about 24 hours later on May 2, 1980. The cask contained one spent fuel assembly, known to have failed cladding. Failed fuel has been received on previous occasions at WJNF.

(2) The shipper's cask survey records, which were forwarded to WJNF with the shipping papers, show that radiation and contamination levels of the shipment were within DOT limits. Measurements made by the receiver were also within limits. A licensee representative stated that additional shielding in the form of lead between sheets of plywood was bolted to the side of the cask enclosure.

(3) The licensee checked the internal atmosphere in the cask. A gage connected to the cask vent indicated ambient pressure. A sample collected in a one-liter bottle indicated a radiation level of 6 mR/hr and the presence of krypton gas. This finding was not considered unusual, because of the failed condition of the fuel cladding.

(4) Before immersing the cask in the pool, the cask was backfilled with water to prevent thermal shock to the fuel when the cask lid was removed. This was done by attaching tubing to the upper and lower cask vents and introducing water into the cask through the lower vent. The upper tubing was vented into the High Energy Cell.

(5) After immersion, the cask lid was removed. A dark cloud emanated from the cask, spread through the pool water, and rose to the surface. The event caused chirpers worn by the operators to respond and caused a radiation level of about 200 mR/hr three feet above the water level, as measured by a portable instrument. Floor smears taken about ten minutes later disclosed contamination. The lid removal took place at about 11:00 p.m. on May 2, 1980.

(6) Work continued until the fuel assembly was removed from the cask and placed in a pool storage rack. The five persons (the Hot Cell Laboratory supervisor, three operations technicians, and a health physics technician) ceased operations about midnight. Subsequent entries into the pool area were made wearing respirators, which had not been previously required.

c. Principal consequences of the incident are summarized below:

(1) Surface areas and equipment in the pool area were generally contaminated. Contamination levels before cleanup began on May 3, 1980 were 200-200,000 dpm/100cm^2 beta-gamma and 20-2800 dpm/100cm^2 alpha. The licensee control limits are 20 dpm/100cm^2 alpha and 200 dpm/100cm^2 beta-gamma. The

decontamination effort required significant labor and supplies. At the time of the inspection, decontamination was virtually completed except for some small areas above the high level cell and on crane parts.

(2) Normal work activities in the laboratory were not interrupted. Two fuel assemblies from Connecticut Yankee were received and unloaded on May 8, 1980 and May 15, 1980 without incident. The cladding of these assemblies was intact. The cask used was NAC-1D.

(3) Nasal swabs, film badge measurements, urinalyses, fecal samples, and in vivo counts were required from the five individuals involved in the incident. None of these indicated significant doses. The highest film badge measurement was 220 millirem gamma. Urinalyses disclosed no significant radioactive material. A series of fecal samples collected on May 4, May 6, May 8, and May 14, 1980, disclosed no significant radioactivity after the first samples. The highest initial sample measured 19,000 dpm. All five individuals received in vivo counts on May 3, 1980. Results were not significantly different from results of routine semiannual counts. A summary is tabulated below:

Radionuclide	No. Induviduals	Max. % MPBB
Cobalt-58	1	0.116
Cobalt-60	3	0.740
Cesium-134	3	0.098
Cesium-137	5	0.057

(4) Continuous air monitors were in operation during and after the cask opening. The highest air activity detected was for a period of approximately 1.5 hours shortly after the incident. The concentrations were 4.5 E-11 µCi/cc alpha and 1.7 E-10 µCi/cc beta. MPC limits are 2 E-12 µCi/cc alpha and 1 E-9 µCi/cc beta. While air concentrations were variable and sometimes exceeded MPC limits in days following the incident as measured by fixed air monitors and lapel samplers worn during decontamination, the licensee stated that MPC limits were not exceeded for any 40-hour period.

(5) The concentration of radioactivity in the fuel pool water reached a peak of about 4 E-1 µCi/ml beta and 5 E-3 µCi/ml alpha after the incident. These concentrations were reduced over a period of weeks by circulating the water through the installed ion exchange resin beds. At the time of the inspection, concentrations were below the limits of 1 E-3 µCi/ml beta and 1 E-4 µCi/ml alpha imposed by License Condition 18 of SNM-7. The concentrations above the license limit are an item of noncompliance.

d. The heat content of the cask containing the failed Connecticut Yankee fuel assembly was 2.09 kW according to information in the shipping papers accompanying the shipment. The license for NFS-4 casks permits a heat load of 2.5 kW for assemblies shipped in a dry cask, as was the Connecticut Yankee assembly. After the contamination incident, the licensee calculated the heat load to be 3.1 kW and informed the shipper of this estimate. Recalculations by the shipper established the heat load as 3.50 kW. The shipper notified Region I of the NRC of the excessive heat content by letter dated May 21, 1980, and acknowledged noncompliance with the cask license.

e. After removal from the fuel pool, the NAC 1-E cask was prepared for reuse. Several internal flushes were made, using water, then a Turco solution, then water again. A temporary flushing system which included ion exchange resin columns and filters was used in flushing. Concentrations of radioactivity in final flush samples were about 1 E-2 μCi/ml alpha and one μCi/ml beta. The cask was cleaned externally and prepared for shipment. Surveys indicated that radiation and contamination levels were within DOT limits. The empty cask was sent to the Oyster Creek nuclear power plant for the shipment of spent fuel rods to the Hot Cell Laboratory.

f. During the cask flushing operation described in the preceding paragraph, an employee received a dose of about 31 rems to the right hand. This exceeds the limit of 18 3/4 rems per quarter permitted by 10 CFR 20.101 and, therefore, is an item of noncompliance. The licensee notified NRC of the overexposure in a written report as required by 10 CFR 20.405. The overexposure occurred while the employee was removing a cartridge from a water filter in the temporary flushing system. This was a planned operation for which a work request had been approved, an exposure time of three minutes estimated, and a extremity dose estimate of 3 rems made. Although a second worker was available to provide assistance if needed, no time limit was established or enforced. The exposed worker apparently required longer than the estimated time to remove the cartridge, place it in a bag, and carry it to a shielded container for disposal. The dose was measured by a TLD finger ring worn on the right hand. The total body dose received by the worker during the two-week period including the hand overexposure was 850 millirems of gamma radiation. Corrective actions planned to prevent recurrence of similar overexposures include more strict time restraints and the use of remote handling equipment when possible. While these are appropriate actions, implementation must be general rather than specific, since the equipment involved was temporary and circumstances are unlikely to be repeated.

g. After the empty NAC-1E cask arrived at the Oyster Creek plant on July 23, 1980, the receiver reported removable contamination on the cask. The contamination was present in a small area and did

not exceed the DOT limit of 2,200 dpm/cm^2 for removable contamination on a package in an exclusive use vehicle (49 CFR 173.397). However, the radiation level in an area on the under surface of the trailer was about 240 mR/hr, as measured by the receiver and confirmed by an NRC resident inspector. The high radiation area was beneath one of the two cask drain ports. 10 CFR Part 71.5 states that no licensee shall deliver licensed material to a carrier for transport unless the licensee complies with the applicable requirements of the Department of Transportation in 49 CFR Parts 170-189. 49 CFR 173.393(j)(2) limits the radiation level at any point on the external surface of a closed transport vehicle to 200 mR/hr. This matter is considered an unresolved item, pending further investigation. (See paragraphs 8 and 9.)

h. The licensee provided assistance at Oyster Creek to decontaminate the empty cask. Three individuals were involved in an effort that lasted about three weeks. The last licensee representative departed Oyster Creek with the understanding that contamination was within DOT limits.

8. Unresolved Item

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. An unresolved item disclosed during the inspection is described in paragraphs 7g and 9.

9. Management Meeting

In a meeting at Region III on November 12, 1980, licensee management representatives met with Region III management and staff to discuss matters related to the condition of the NAC - 1E cask on arrival at Oyster Creek after being transported from the licensee's facility, in particular the high radiation level beneath the trailer (paragraph 7g). The licensee described in detail the extensive flushing procedures used in cleaning the cask interior, and presented data supporting their conclusion that the cask was in compliance with DOT and NRC regulations when shipped to Oyster Creek.

The following attended the meeting

Licensee

W. J. Madia, Manager, West Jefferson Nuclear Facility
V. J. Pasupathi, Manager, Hot Cell Laboratory
H. L. Toy, Licensing Coordinator
G. H. Kirsch, Health Physicist

Region III

J. G. Keppler, Director
A. B. Davis, Chief, Fuel Facility and Materials Safety Branch
W. L. Fisher, Chief, Fuel Facility Projects and Radiation Support Section
C. C. Peck, Fuel Facility, Inspector

10. Radiation Protection

a. External Exposure Control

Biweekly results of TLD badge measurements were reviewed from the period since the inspection in April 1980 (Report 80-01) through mid-August. No doses exceeding the limits of 10 CFR 20.101 were noted. The maximum whole body dose to any individual in the first half of the year was about 1600 millirems.

The overexposure to the hand of one individual was described in Paragraph 7f.

b. Internal Exposure Control

In vivo counts of Hot Cell Laboratory employees, most recently conducted in April 1980, indicated no mixed fission products exceeding 1% of the maximum permissible body burden in any individual.

Quarterly urinalyses for Plutonium and Hot Cell Laboratory workers for 1980 through mid-August indicated no significant concentrations of radioactivity.

Results of special bioassays of workers involved in the spent fuel cask incident of May 3, 1980, were described in Paragraph 7c.

No items of noncompliance were identified.

11. Exit Interview

In meeting with licensee representatives identified in Paragraph 1 at the conclusion of the inspection, the inspector summarized the scope of the inspection and the inspection findings.

The licensee acknowledged the noncompliance concerning the overexposure to the hand (Paragraph 7f). Concerning the noncompliance for exceeding radioactivity concentration limits in the fuel pool (Paragraph 7c.5), the licensee thought the citation unjustified, because the event was unavoidable. However, future contamination incidents, including contamination of the pool water, may be prevented by procedures requiring confirmation of heat load calculations and by modified packaging requirements for failed fuel shipments.