

U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No. 70-1257/90-04

Docket No. 70-1257

License No. SNM-1227

Licensee: Advanced Nuclear Fuels, Inc.
2101 Horn Rapids Road
Richland, Washington 99352-0130

Facility Name: Advanced Nuclear Fuels, Inc.

Inspection at: Richland, Washington

Inspection Conducted: December 3-7, 1990

Inspector:

Robert J. Pate for
C. A. Hooker, Fuel Facilities Inspector

1/15/91
Date Signed

Approved by:

Robert J. Pate
Robert J. Pate, Chief
Nuclear Materials and
Fuel Fabrication Branch

1/15/91
Date Signed

Summary:

Areas Inspected: This was a routine unannounced inspection of management organization/controls, criticality safety, operations review, radiation protection and followup on NRC Information Notices. Inspection procedures 30703, 88005, 88015, 880020, 83822 and 92701 were addressed.

Results: The licensee's overall performance appeared adequate. However, weaknesses were identified relative to (1) evaluation and controls of their criticality monitoring system that resulted in one unresolved item (Section 3), and (2) failure to conduct an adequate survey that resulted in a Non Cited Violation (NCV) described in Section 5.a.

DETAILS

1. Persons Contacted

A. Advanced Nuclear Fuels (ANF)

- *W. E. Stavig, Manager, Safety, Security and Licensing
- #*C. W. Malody, Manager, Regulatory Compliance
- *B. N. Femreite, Manager, Manufacturing Engineering
- *R. L. Feuerbacher, Manager, Plant Operations
- *J. W. Helton, Manager, Plant Engineering
- *M. G. Hill, General Supervisor, Chemical Operations
- *T. C. Probasco, Supervisor, Safety (SS)
- *C. D. Manning, Criticality Safety Specialist (CSS)
- *J. E. Pieper, Health Physics Specialist (HPS)
- *E. L. Foster, Radiological Safety Specialist
- *W. V. Jackson, Supervisor Traffic
- W. G. Keith, Manager, Mechanical/Chemical, Plant Engineering

*Denotes those attending the exit interview on December 7, 1990.

#Denotes telephone conversation on December 11, 1990.

In addition to the individuals noted above, the inspector met and held discussions with other members of the licensee's staff.

2. Management and Organization (88005)

This area was reviewed to determine the licensee's compliance with the requirements of the License and licensee procedures.

There had been no changes in the organizational structure in the Safety, Security and Licensing (SS&L) Department since the last inspection of this area (70-1257/90-01). Regarding personnel changes, as of November 1, 1990, the CSS's position had been filled by an individual hired from an outside agency. The individual previously assigned to this position transferred to another onsite department (Neutronics & Fuel Management), and was available to provide assistance to the new CSS. Part I, Section 2.2.5 of the License requires that the CSS shall hold a B.S. degree in Science or Engineering and have two years of experience in nuclear criticality safety analysis. Based on discussions with the CSS and review of his resume, the inspector identified no concerns regarding this individual's qualifications for the assigned position.

The inspector noted that there had been no changes in the functions and responsibilities of the Health and Safety Council (HSC). Minutes of monthly HSC meetings conducted during the past six months were reviewed. The inspector noted that meetings included a review of various aspects of ANF's criticality, radiological and industrial safety programs. The meeting minutes also included, in addition to other data, attachments reporting the results of (1) monthly housekeeping and safety inspections conducted by designated members of the HSC, (2) monthly HP audits, (3)

personnel injuries that had occurred, (4) monthly criticality safety audits, and (5) a summary of bioassay analytical data. Identified deficiencies were tracked as open items until they were resolved. The inspector noted one item of concern regarding a Health Physics Corrective Action Request involving the licensee's program for testing underground contaminated liquid transfer lines, which is discussed in Section 5 below.

Selected licensee operating procedures, standards and guides were reviewed. The inspector noted from these samples, that the licensee's procedure control system included the appropriate reviews and approvals were conducted in conformance with the requirements specified in Part I, Section 2.5 of the License.

The licensee's program in this area appeared adequate to accomplish its safety objectives. No violations or deviations were identified.

3. Criticality Safety (88015)

The inspector reviewed the licensee's program for compliance with the requirements of 10 CFR Part 70, License Conditions, licensee procedures, and recommendations outlined in various industry standards.

a. Criticality Safety Analysis (CSA)

The inspector reviewed the following CSA that had been performed since the last inspection of this area:

- (1) CSA U-19.2, dated July 24, 1990, for the storage of packaged low enriched fuel pellets (less than 5.0 weight percent U-235) in the Zimmer Warehouse.
- (2) CSA U-5.0, dated July 2, 1990, for Japanese pails for a NT-IX Shipping container.
- (3) CSA LAG-5.0, dated April October 10, 1990, for the addition of a filter to the liquid waste discharge line to the sewer from Lagoon 5A. The filter was installed due to higher than normal uranium concentrations being observed in the licensee's monthly sewer sludge samples. During the first six months of 1990, monthly sample results ranged from 7.72 picocuries of uranium per gram of sludge (pCi/U-gm) to 15.98 pCi/U-gm. From August through October 25, 1990, sewer samples ranged from 21.1 pCi/U-gm to 24.72 pCi/U-gm.

Part I, Section 5.2.3 of the License requires, in part, that any confirmed monthly sludge sample result of 25 pCi/U-gm or higher will be brought to the attention of Chief, Fuel Cycle Safety Branch, NRC. The licensee was evaluating this matter, which will also be reviewed in more detail by the inspector during a future inspection and is considered as an open item (70-1257/90-04-01).

Each CSA had been performed by the CSS. The CSAs appeared to be

conservatively modeled for each condition in accordance with the licensee's procedures and requirements of the License. The second party reviews were performed by the HPS in accordance with the requirements delineated in Part I, Section 4.1.1 of the License.

b. Criticality Monitoring System

The criticality accident monitoring system used at ANF consists of neutron criticality detectors (NCDs). Each NCD panel is made up of three externally moderated BF_3 tubes which are operated in a two-out-of-n coincidence.

Part I, Section 1.6.1 of the License, first paragraph states, "Pursuant to 10 CFR 70.24.(d), Advanced Nuclear Fuels has previously requested exemption from the requirements of 10 CFR 70.24(a), and has been duly authorized to use the criticality accident alarm system described below in its facilities. In addition, the waste storage lagoons have been exempted from coverage by the criticality accident alarm system."

Section 1.6.1 further states, in part, that: (1) the trip point of each NCD is set to trip within 1-5 seconds at 80 millirem per hour (mrem/hr) of fast neutrons; (2) the neutron dose rate delivered through 12 inches of concrete to a NCD at 300 feet as a result of a minimum of $1.0\text{E}14$ fissions has been calculated to be approximately 350 mrem/hr; and (3) except for the waste lagoons which have been exempted from coverage by the criticality accident alarm system, all special nuclear material at the Advanced Nuclear Fuels plant shall be located such that a criticality accident of $1.0\text{E}14$ fissions occurring in the material would produce a minimum of 350 mrem/hr at a set of three NCDs, considering distance and intervening shielding materials.

During facility tours, the inspector noted that the accumulation of ash drums (nominal 35-45 gallon drums) being stored in the southeast corner of licensee's outside storage yard had greatly increased in number since the previous inspection. The ash drums originate from the licensee's incinerating process in the Solid Waste Uranium Facility (SWUR) and are stored for ultimate uranium recovery. During the past year, the licensee has generated about 460 drums with about 480 drums currently in storage. The drums contain low enriched uranium (nominally less than 5.0 weight percent U-235). The U-235 content of each drum ranged from about 50 to 300 gms and were stored in an unlimited single-tier array. The inspector questioned the distance of the ash drum storage area to the nearest effective set of NCDs, which were located in an inner room in the carpenters shop.

Using a tape measure, the inspector observed that the distance from the first row of ash drums to the NCDs was about 300 feet and about 363 feet to the most remote drum in the array. Although there appeared to be no intervening concrete shielding between the NCDs and ash drum storage area, the inspector observed a large stack (about 8 feet wide, 10 feet high and 12 feet long) of thick

framed wooden pallets stored in an intervening location between the drums and NCDs. The licensee's storage yard is also utilized for the general storage of waste drums and large boxes of waste which are stacked to various heights and depths throughout yard area and subject to relocation within the yard area.

The inspector noted that the NCDs in the carpenters shop also provided criticality detection coverage for the nearby Lagoon Uranium Recovery (LUR) facility. The distance between the LUR facility and the NCDs also seemed questionable after observing the measurements obtained of the ash drum storage area. The measurement of the distance from the center of the LUR liquid processing vessels to the NCDs was observed to be about 348 feet.

The licensee's evaluation, "Criticality Alarm Detector Location and Coverage," dated September 6, 1983, for the LUR facility was reviewed. The evaluation concluded that the NCDs in the carpenters shop provided adequate criticality monitoring coverage for the LUR facility. The evaluation was primarily based on an attached scaled drawing which depicted a distance of 300 feet between the outer wall of carpenters shop and the entrance gate to LUR facility. The inspector also noted that the evaluation appeared not to consider the distance (about 18 feet as measured) from the LUR facility's entrance gate to the process vessels nor the distance (about 30 feet as measured) from the outer wall of the carpenters shop to the location of the NCDs within.

Based on conversations with cognizant licensee representatives and review of licensee records, the inspector noted that (1) no evaluation had been performed to demonstrate that the ash drum storage was being adequately monitored by NCDs, and (2) the licensee did not have a program to limit the the storage of intervening shielding materials between the NCDs and areas they monitored.

The inspector noted that the calculation used for the 350 mrem/hr at 300 feet license requirement was contained in a licensee document "Criteria for Criticality Alarm Systems", dated May 7, 1970. The calculation was based on a criticality accident having a burst of $1.0E14$ fissions delivered in one second which has been considered the minimum accident for a plutonium system. The minimum criticality accident for uranium systems has been considered to be about $1.0E15$ fissions. The licensee had previously been involved in operations using Pu-239, however, current operations are only conducted with low enriched uranium.

The inspector's observations were discussed with cognizant licensee representatives during the inspection and at the exit interview on December 7, 1990, and were acknowledged by licensee. The inspector also acknowledged comments from the licensee regarding conservatism in their use of $1.0E14$ fissions as opposed to $1.0E15$ fissions for uranium and the attenuation of 12 inches of concrete. At the exit interview the Manager, SS&L stated that evaluations to support the adequacy of the criticality monitoring would be conducted and

documented, and that a program would be established to control the storage of intervening shielding materials. The inspector also informed the licensee that in addition to the LUR facility and ash drum storage area, other onsite storage and operating areas should also be evaluated to ensure that all areas were being adequately monitored, and considerations should be given as to the source term (criticality accidents from solid systems and those from solutions).

Concerns regarding the ability of the criticality monitoring system's capability to perform its function as required by the License is considered as an unresolved item (70-1257/90-04-02):

An unresolved item is an item about which more information is required to ascertain whether its an acceptable item, deviation or a violation.

During a telephone call between the licensee representative, denoted in Section 1, and the inspector on December 11, 1990, the licensee representative stated that their evaluation concluded that the ash drum storage area was being adequately monitored by the NCDs in the carpenters shop; however, the NCDs were being relocated to a higher elevation in order to provide adequate monitoring coverage for their new loading bay in the warehouse. The inspector informed the licensee representative that the issue remained unresolved.

There had been no changes in calibration of the NCDs from that described in previous inspections. Bench top calibration of the NCDs and overall system reliability tests continued to be conducted annually and quarterly, respectively.

c. Other Observations

During facility tours, the inspector observed that criticality control limits appeared to be appropriately posted where special nuclear material was being processed, handled and stored. Each storage container observed was labeled with the enrichment and quantity of material. Leakage from wet operations appeared to be minimal.

The inspector reviewed and discussed tests conducted to determine the integrity of the boron neutron absorber spiders used in 45 gallon low enriched uranium oxide powder storage drums with the Manager, Process Engineering. These tests consisted of a destructive evaluation of a selected drum by age group. Initially tests were conducted yearly, then every two years and currently every five years based on historical data from previous tests. The tests appeared to be very thorough and well documented. No leakage or cause to suspect leakage of the absorber material had been identified from drums tested. The licensee has estimated 30 years of active service from each drum. The inspector determined that the tests were being conducted in accordance with the requirements outlined in Part I, Section 4.2.4 of the License.

No violations or deviations were identified.

4. Operations Review (88020)

This area was reviewed to determine if operations were being conducted in accordance with the requirements of the License, licensee procedures, and recommendations outlined in various industry standards. The inspection of this area was primarily based on observations made during facility tours.

There were no significant changes in operations since the previous inspection. Both chemical conversion lines were in full operation, and the powder lines and pellet presses were being operated as demanded. The SWUR Facility was in full operation, and the Neutron Absorber Facility was operating.

In the areas toured, the inspector observed that (1) the exhaust ventilation systems appeared to be fully functional, (2) pressure drops across the main filters were within the limits specified in the license, (3) current air flow measurements were posted on exhaust hoods, and (4) housekeeping appeared good.

Utilizing licensee procedure "Preparing and Removing UF₆ Cylinder" the inspector observed the preparation of uranium hexafluoride (UF₆) cylinder for vaporization on Line 2 and portions of the same operation on Line 1, simultaneously. The procedure adequately listed the equipment used for the task, personnel and equipment safety precautions, cold cylinder valve checks, cylinder vacuum checks, and cylinder valve leak checks and heating temperatures. Due to problems encountered on each line, the inspector was unable to observe operations throughout the heating process. The cylinder at Line 2 indicated no vacuum (to be greater than 10 inches Hg) during the initial checks and preparations had to be made for pumping it down to complete the remaining checks prior to cylinder heating. On Line 1, the operator encountered a plugged pigtail (line from the cylinder to the UF₆ header). In each case the operators appeared to be knowledgeable of the tasks being performed and followed the steps detailed in the procedure, which included notifying the operations supervisor when the problems were encountered. No significant safety concerns were identified by the inspector. Observations of minor procedural administrative inconsistencies were discussed with the operations supervisor.

The licensee's program appeared adequate to the accomplishment of its safety objectives. No violations or deviations were identified.

5. Radiation Protection (83822)

Inspection Report Nos. 70-1257/90-02 and 03 documented previous reviews of the licensee's radiation protection program. This inspection was primarily focused on the review of licensee events, observations made during facility tours and discussions with licensee representatives.

a. Personal Clothing Contamination Incident (RV-90-A-0070)

Condition 9 of the License No. SNM-1227 authorizes, in part, the use of licensed materials in accordance with statements, representations and conditions contained in Part 1 of the License Application.

Part I, Section 3.2.6.2, item 1.a. of the License Application requires all personnel leaving a contaminated area to survey themselves for contamination with survey instruments located at respective step-off areas after removing protective clothing, and prior to leaving the step-off area. Item 1.b of this Section requires that personnel are not to eat or leave the respective facility, except with the approval of the Radiological and Industrial Safety Supervisor and the respective facility manager, if their personal clothing is contaminated in excess of 200 dpm/100 cm² (alpha) direct, or skin is contaminated in excess of 200 dpm/100 cm² (alpha).

On November 27, 1990, prior to the inspection, the inspector became aware of an incident involving an employee that had apparently left the licensee's facility with a contaminated shoe. The contaminated shoe was discovered at a nearby facility during the individual's exit survey, subsequent to a group tour on November 15, 1990. The visited facility verbally notified ANF of the incident on November 16, 1990, with written notification to follow.

Survey results and other information provided to the NRC Region V office from the visited facility indicated 13,000 disintegrations per minute (dpm) beta/gamma and 1,500 dpm alpha fixed contamination on the shoe. The shoe was confiscated after decontamination efforts were unsuccessful. An isotopic analysis of the contamination determined that the source of alpha contamination was U-235, which was known not to be present in the areas toured by the individual. Surveys, by the visited facility, of the areas toured by the individual did not detect any contamination.

On November 29, 1990 the inspector contacted the licensee by telephone and discussed the incident. This matter was further reviewed during the onsite inspection, which included discussions with the individual who had the contaminated shoe. In addition to the information noted above, the inspector made the following observations:

- (1) On November 15, 1990, the individual (a qualified HP technician) informed the SS of the matter shortly after arrival to work a scheduled p.m. shift. Shortly after informing the SS of the matter, the individual obtained a portable survey meter, equipped with a thin window pancake probe, and conducted a direct survey of selected areas of his residence where the shoe may have had contact. The individual's vehicle was not surveyed. No contamination was detected during the survey of the residence.

- (2) On December 3, 1990, the licensee acknowledged that the contamination on the individual's shoe had apparently come from ANF. According to the individual, the contamination (fixed) involved a small area near the top outside surface of the shoe, where the top of a protective rubber shoe cover contacts the shoe. The individual also stated that he had surveyed the bottom of his shoes when he exited contaminated areas before the incident, however, he did not survey the top portion of his shoes. Alpha survey meters are the primary instruments used for personnel surveys at the exits of contaminated areas. The individual suspected that the contaminated shoe may have resulted from wearing a contaminated reusable rubber shoe cover. Typically, routine tasks are performed without wearing a cloth or plastic boot between personal shoes and rubber shoe covers. Rubber shoe covers are also reused at the facility.

The licensee's corrective actions regarding this matter included the SS stressing, to the individual involved, the importance of performing a more thorough personal survey when exiting contaminated areas. The SS informed the inspector that ANF was waiting for receipt of written official notification of the incident from the visited facility before taking any further action, which would have included notifying Region V. The SS also informed the inspector that ANF (1) was in the process of phasing out the normally used standard rubber shoe covers for high-top shoe covers which should limit the potential for such occurrences in the future, and (2) their proposed budget had included the purchase of an Eberline PCM-1B whole body personnel contamination monitor that would be placed at a strategic location for use by personnel who had been working in contaminated areas, providing the budget gets approved. The SS also informed the inspector that no contamination has ever been detected on personal clothing through their routine program of performing surveys on selected groups of workers at the end of the work day.

During a discussion with the SS on December 3, 1990, he acknowledged that it may be prudent to conduct an independent survey by someone other than involved individual. On December 3, 1990, the independent survey was performed using the same instrument previously used. In addition to a direct scan survey, the survey included large area wipe tests, small area wipe tests counted in a lab counter, and direct scans and wipe tests of the individual's vehicle. No contamination was detected.

- (4) On December 4, 1990, the licensee received a letter dated November 27, 1990, from the facility that had identified the contaminated shoe. The letter primarily confirmed the verbal information provided to the licensee on November 16, 1990, and did not alter any previous information provided to the inspector and the licensee.

Based on review of the above observations, failure to perform an adequate survey that resulted in a worker exiting the facility with contaminated personal clothing was identified as an apparent violation of License Condition No. 9. Based on the safety significance of this problem and the corrective actions taken by the licensee, this violation is not being cited because the criteria in Sections V.A. of the Enforcement Policy were satisfied (NCV 70-1257/90-04-03).

b. Control of Radioactive Materials

In 1988 the licensee established a program and schedule to test underground contaminated liquid transfer lines for leakage. During the review of monthly HSC meeting minutes, the inspector noted that on August 16, 1990, the HPS had initiated a Health Physics Action Request to have the floor drain system associated with the tank gallery and Miscellaneous Uranium Recovery System in the UO₂ Building tested. He noted that testing of this system had not been completed during the licensee's July 1990, outage as scheduled. The HPS recommended that the drains system not be used until it had been pressure tested. On August 17, 1990, the subject drain system was plugged and tagged out to suspend its use.

By letter dated September 5, 1990, the manager in charge of this project responded to the HPS regarding this matter. As noted from the letter, on August 27, 1990, the underground drain line from the North and South Tank Galleries was pressure tested. The pressure test indicated a leakage rate of about 0.3 gallons per hour under 4 feet of water head pressure. The drain opening (floor) in each room and associated sump in the North room were plugged and sealed. The letter also stated (1) that separate sumps would be set up in each tank gallery, but no underground piping would be used and (2) that the existing line was permanently abandoned and should be included in the ANF decommissioning files.

The inspector discussed the drain line leakage with the manager in charge of the project and the HPS. During this discussion the inspector was informed that other than being used as a floor drain system, the drain line had occasionally been used as a transfer line between the two rooms. The inspector questioned these individuals as to the uranium concentration of liquids normally encountered in this area and if any evaluation had been performed to determine the quantity of radioactive material that may have leaked into the ground area. According to these individuals, no such evaluation had been performed and although the uranium concentration was believed to be low, no specifics could be provided at this time.

This matter of performing an evaluation of the potential leakage of radioactive material from the drain was also discussed with SS&L management and at the exit interview. The licensee agreed to perform an evaluation, which will be reviewed during a subsequent inspection. The inspector considers this matter as an open item (70-1257/90-04-04).

One apparent NCV was identified.

6. Followup on IE Information Notices (72701)

The inspector verified that the licensee had received and reviewed IE Information Notices Nos. 90-63 and 90-70.

7. Exit Interview (30703)

The inspector met with the licensee representatives, denoted in Section 1, at the conclusion of the inspection on December 7, 1990. The scope and findings of the inspection were summarized.

The observations described in the report were acknowledged by the licensee. The licensee was informed of the apparent NCV described in Section 5.a. of this report.