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

Region I

Report No. 70-687/80-04

Docket No. 70-687

License No. SNM-639 Priority 1 Category UR

Licensee: Union Carbide Corporation

P.O. Box 324

Tuxedo, New York 10987

Facility Name: Sterling Forrest Research Center (Hot Laboratories)

Inspection at: Tuxedo, New York

Inspection conducted: July 29 - August 1, 1980

Inspectors: W. W. Kinney 8/27/80
W. W. Kinney, Project Inspector date signed

date signed

date signed

Approved by: H. W. Crocker 9/3/80
H. W. Crocker, Chief, Fuel Facility date signed
Projects Section, FF&MS Branch

Inspection Summary:
Inspection on July 29 - August 1, 1980 (Report No. 70-687/80-04)
Areas Inspected: Routine, unannounced inspection by a region-based inspector of: licensee action on previously identified enforcement items; organization; nuclear criticality safety; operations; uranium waste form processing operation; ventilation system; emergency electrical system; Nuclear Safeguard Committee activities; audits; and training. The inspection involved 29 inspector-hours onsite by one region-based inspector.
Results: No items of noncompliance or deviations were observed in 8 of the areas completed. Two apparent items of noncompliance were observed in nuclear safety and one item was observed in operations (infraction - Failure to have a criticality monitoring system which meets the requirement of 10 CFR 70.24(a) - paragraph 4a; infraction - Failure to post secondary welding location with nuclear safety sign - paragraph 4b; infraction - Failure to maintain contamination control in accordance with license conditions - paragraph 5a).

DETAILS

1. Persons Contacted

*J. J. McGovern, Business Manager, Radiochemicals
*D. D. Grogan, Supervisor, Radiochemical Production
F. J. Morse, Process Engineer
H. C. Hart, Facility Engineer
*L. C.Thelin, Supervisor, Health Physics

The inspector also interviewed the target preparation supervisor and five technicians during the course of the inspection.

*denotes those present during the exit interview.

2. Licensee Action on Previously Identified Enforcement Items

(Closed) Infraction (79-05-01): The air velocity into a plating laboratory hood in the operator's breathing zone was 50-75 linear feet per minute rather than the required 100 to 150 linear feet per minute. The inspector verified that the licensee installed a mechanical stop which restricts the window opening on the hood.

(Closed) Deficiency (79-05-02): Areas used for storage of unirradiated U-235 contaminated waste in drums were not posted with nuclear safety signs. The inspector verified that the licensee had marked off areas for storage of the waste filled drumms and had nuclear safety signs posted at the areas.

(Closed) Deficiency (79-05-04): Two Model B-3 shipping casks used to transport irradiated U-235 waste to a burial ground were not constructed in accordance with Battelle Memorial Institute (BMI) Drawing No. 9958-8501-00E, Revision B or C, specified in Certificate of Compliance No. 6058, Revision 4, dated April 27, 1979. The inspector verified that the licensee took the casks out of service on the advice of the Transporation Certification Branch of the NRC until the Certificate of Compliance was revised to describe the as-built casks. The licensee performed a design review and supplied the resulting information to the NRC so that Certificate of Compliance No. 6058 could be revised to call for the correct design of the casks.

3. Organization

The organization concerned with the safety of the operations authorized by License No. SNM-639 is shown below.

R. E. Bollinger, Vice President/General Manager, Nuclear Products
M. W. Sowa, Director, Administration
C. J. Konnerth, Manager, Health, Safety and Environmental Affairs
L. C. Thelin, Supervisor, Health Physics
J. J. McGovern, Business Manager, Radiochemicals
F. J. Morse, Manager, Process Engineering
D. D. Grogan, Supervisor, Radiochemical Production
G. W. Wright, Supervisor, Target Preparation
E. L. Coon, Assistant Production Supervisor
J. F. Lucas, Supervisor, Production and Inventory Control
H. Korson, Supervisor, Packaging
M. H. Voth, Manager, Nuclear Operations
H. C. Hart, Facility Engineer
E. P. O'Gull, Manager, Materials Management
W. W. Leinheiser, Supervisor, Quality Control

The organization is essentially the same as previously reported in Inspection No. 79-05.

4. Nuclear Criticality Safety

a. Criticality Accident Alarm System

The criticality accident alarm system employed by the licensee for coverage of the areas where special nuclear material is possessed under License No. SNM-639 is not in compliance with 10 CFR 70.24(a), criticality accident requirements. The system also doesn't conform to Regulatory Guide 8.12. Criticality Alarm Systems. This criticality accident alarm system and its shortcomings are discussed below.

According to the license, the licensee is supposed to have "area radiation monitrons" located in 15 different positions throughout the Hot Lab. The inspector reviewed the locations of the monitrons against the figure given in the license. The licensee has removed a monitron from the ion exchange column location for use as a spare, since the licensee does not use the ion exchange columns for treatment of radioactive waste water. The licensee also has two monitrons in the Hot Lab which are not shown in the figure given in the license. Also, the figure in the license does not show the monitors for the special nuclear material possessed under SNM-639 which is handled, stored, or stored in the reactor area.

Five of the monitrons are located in the hot cells, and these five monitrons are not part of the criticality alarm system as allowed by License Condition 13. The eleven monitrons which make up the criticality alarm system in the Hot Lab have bell alarms. Two monitrons located in the second level area above the cells also cause the Hot Lab evacuation signal, a horn, to sound. The other nine monitrons do not cause the Hot Lab evacuation horn to sound.

Instead, the evacuation horn must be manually actuated. This evacuation horn is manually sounded in the event of alarms from: two area radiation monitrons; an area radiation monitron and a constant air monitor; or an area radiation monitron and the stack air monitor. This criticality accident alarm system does not meet the requirements of 10 CFR 70.24(a).

10 CFR 70.24(a) requires that the radiation detectors energize clearly audible alarm signals if accidental criticality occurs. Further, it requires that emergency procedures assure that all personnel withdraw to an area of safety upon the sounding of the alarm. Nine of the area radiation monitrons do not energize the evacuation alarm signal. They do energize an alarm bell signal; however, the emergency procedures do not require that the personnel evacuate upon hearing the monitron bell signal. Instead, a person must actuate the evacuation alarm horn after determining that two alarm signals have been actuated. This is an item of noncompliance (80-04-01).

The two monitrons located in the second level area above the cells which do cause the evacuation horn to sound automatically have electrical circuits such that concurrent monitron response is required before the evacuation horn is actuated. This is done to avoid false alarms. There is a problem with the licensee's system in that failure of one of the monitrons does not necessarily put the failed monitron in the alarm state. Therefore, failure of one of the monitrons may cause the loss of the entire criticality monitoring system for the second level area above the cells. This situation is contrary to Section 4.4.1 of American National Standard N16.2-1969 which is conditionally acceptable to the NRC as given in Regulatory Guide 8.12, Criticality Accident Alarm Systems. Section 4.4.1 of ANSI N16.2-1969 states, "In redundant systems, failure of any single channel shall be in the alarm state. Warning of the malfunction without activation of the alarm should be provided."

The inspector also requested the licensee to show him the analyses which showed the areas covered by each of the area radiation monitrons considering the requirements of 10 CFR 70.24(a)(2). This was to determine whether all the areas where special nuclear material is handled, used, or stored are covered by at least two area radiation monitrons or if some areas are covered only by one monitron. The licensee was not able to show the areas covered by each of the monitrons to the inspector. The licensee stated that each area of concern was covered by at least two monitrons; however, with the amount of shielding present in the facility a detailed analysis of the coverage supplied by the monitors is warranted.

The alarm points of the area radiation monitrons were set at 5mR/hr. or 10 mR/hr. except for a unit in the exhaust air filter room. This monitron was set to alarm at 100 mR/hr. This setting is above that allowed by 10 CFR 70.24(a)(2). If this monitron is one of those required to provide the criticality accident alarm system which satisfies 10 CFR 70.24(a), the set point must be reduced to be between 5 and 20 mR/hr. The settings and radiation readings of the nine monitrons at the main monitron control panel in the operating area of the Hot Lab were as follows.

Monitron Location	Alarm Setting mR/Hour	Radiation Reading
Exhaust air filter room	100	10
Makeup area - South	10	1
Makeup area - North	10	<1
Operating area	10	6
South loading dock	5	<1
Gamma facility	10	3
Charging area - South	10	2
Charging area - North	5	<1
Charging area - by Cell 5	5	<1

The inspector reviewed the licensee records of the daily and monthly checks and yearly calibration of the area monitors.

The daily check is for response of the instrument to a built in source. The monthly check is for response of the audible and visual alarm to the radiation exceeding the set point. The records appear to be kept conscientiously with problems and repairs to units recorded.

The yearly calibration checks use 2.6 mR/hour and 1.3 R/hour radiation sources. The monitron in the operating area has a range from 0 to 100 mR/hour; therefore, it cannot be checked with the 1.3 R/hour source. The licensee recalibrated or replaced units which did not respond satisfactorily during the calibration checks.

b. Administrative Controls

The licensee uses an administrative system for nuclear criticality safety control. The license calls for: a limit of 350 grams U-235 in solution in a single laboratory; a limit of 650 grams U-235 as an oxide in a single laboratory; or for a combination as given by the formula:

$$\frac{\text{U-235 Oxide Form (gms)}}{650} + \frac{\text{U-235 in Solution (gms)}}{350} \leq 1$$

The licensee keeps a running inventory of the amount of material in a criticality control area to assure that the amount of U-235 in an area is within the allowable limit.

By License Condition 14 to the license, the licensee is required to post all storage and use locations with criticality safety signs which indicate the maximum quantity of special nuclear material that is authorized at each location and the actual amount that is present at each location. The running inventory previously mentioned satisfies the requirement for posting the amount of material present. The inspector noted that there was no criticality safety sign at the welding location in the maintenance shop where the secondary is welded to the target. This is an item of noncompliance (80-04-02). The license states that material is never stored or left unattended at the location and the material is considered to be part of that authorized in a storage location in the reactor building. The inspector noted that the license condition required all locations where material is used or stored must be posted.

5. Operations Review

The inspection was initiated with an inspection of the facility. Review of operating procedures and discussions with the operating technicians were also performed.

a. Contamination Control

The licensee requires personnel entering the laboratory room in the second level area above the cells to wear lab coats and shoe covers and to remove the lab coats and shoe covers when leaving these rooms. Monthly smear surveys of the floors and surfaces in these rooms are made, according to the licensee. The smears showed removable contamination on the floor ranging from about 100 dpm to 1200 dpm. The fact that removable contamination exceeds 100 dpm per 100 cm^2 without immediate clean-up and smear surveys of the floors in the laboratories are not made daily is an item of noncompliance (80-04-03). This item involves noncompliance with statements made by the licensee in applications dated April 28, 1969, November 5, 1970, and June 13, 1973. It appears that the licensee's approach to contamination control and personnel contamination protection has changed since these applications were made and approved by the NRC.

b. Housekeeping

The general housekeeping of the facilities appeared to be good. For instance, the inspector noted that there was not an accumulation of combustibles in the room housing the exhaust blower. However, areas of the second level above the cells other than the laboratories appeared to be in general disarray. A 55 gallon drum was located under a safety shower. The licensee moved the drum when this was mentioned by the inspector.

c. Operating Procedures

The inspector asked to see the operating procedures used for operations in the Hot Lab. The licensee gave the inspector a manual which included a section entitled "Hot Lab Operations Manual." According to the manual, the objective of the manual was to ensure that all personnel working in the hot lab area are aware of the requirement for safe and efficient performance of the procedures necessary for the operation of this area.

The inspector reviewed the procedures. Procedure HO-02, General Regulations, provided safety rules applying to operations. The other procedures for operations of the processes and equipment referred to safety equipment to be worn or used during the performance of operations.

The inspector reviewed procedure HO-10 entitled Plating Lab Function, and discussed five of the operations addressed in this procedure with operating technicians. The procedures covered were: Plating Solution Make-Up; Set-Up; Running; Disassembly; and U-235 Consolidation Procedure.

The operating technicians indicated that a copy of the Hot Lab Operations Manual and other pertinent procedures were available in their foreman's office. This office is removed from the operating area; therefore the procedures are not readily available to the technicians at their work stations. During the discussion of the operation, the technicians demonstrated knowledge of the safety requirements. For instance, they were aware of the protective clothing and eye protection requirements. Also, one of the technicians, who was working while the discussions was taking place, lowered the face of a hood after working in the hood, as required by the procedures. The procedural steps outlined by the operating technicians coincided with the procedures given in the Hot Lab Operations Manual.

6. Uranium Waste Form Processing Operation

Amendment No. 4 to License No. SNM-639, dated June 27, 1980, authorized the addition of a uranium waste form processing operation in accordance with the licensee's applicated dated June 2. 1980, as supplemented by License Conditions 18, 19, and 20.

The inspector discussed the status of the start up and evaluation phases of the operation with the licensee. The licensee has completed a one-fourth scale run, a one-half scale run, and one full scale run of the process. The licensee considers the start up phase of the operation to be complete. The licensee plans to perform at least three full scale runs of the process during the evaluation phase of the operation.

The licensee took samples of the offgas from the calcining step during each start up run as required by License Condition 18. The samples were analyzed for the radionuclides and, according to the licensee, the offgas did not contain any radionuclides in amounts which would cause an increase in the radioactivity released from the facility in the gaseous effluents.

The Process Engineering group has developed a basic process procedure for the operation which they are operating by and improving upon as they perfect the uranium waste form processing operation. They are also developing necessary process data sheets for the operation.

The Process Engineering group will also train the operating supervision and technicians in the operation of the process.

According to the licensee, the Nuclear Safeguards Committee has performed a safety evaluation of the process and the conceptual process procedures. The Nuclear Safeguards Committee must also approve the operating procedures prior to Process Engineering turning the process over to Production for routine operation.

The inspector examined the process and storage equipment in the uranium waste form process cell. The arrangement of the equipment and its spacing appeared to be as given in the June 2, 1980 application.

The inspector asked the licensee as to the disposition of the small amount of plutonium present in the waste. The licensee indicated they would determine which stream, oxide or filtrate, contains the plutonium.

7. Ventilation System

The inspector examined the ventilation system with the licensee. The pressure in the ventilation system is regulated to assure a continuous positive airflow from clean areas to contaminated areas. The ventilation system for the exhaust air from the cells goes through two sets of filter banks. Each set of filter banks includes roughing filters, absolute filters, and carbon filters. The ventilation system from each hood or glovebox included absolute filters and the air was also passed through the final set of filter banks which also served the cells. The licensee measures the differential pressure across the filters. These filters are changed after the differential pressure reached 2 inches of water.

The exhaust fan for the ventilation system is a 50 horsepower unit with a capacity of 30,000 cfm against a head of 7.5 inches of water. In the event of an electrical power failure the fan is powered by the emergency gasoline driven generator; however, it is wired so that it operates at only one-half speed.

The emergency fan is a 5 HP unit with a capacity of 8,000 cfm against a had of 3.0 inches of water. The fan is wired into the normal and emergency power. This emergency fan serves only the hot cells. The emergency fan comes on if the negative pressure in the plenum starts to be lost. The start of the emergency fan is checked at least once each year when the belts on the regular fan are changed.

There is also a small fan with a capacity of about 600 cfm which comes on if the pressure in a cell falls below 0.2 inches of water. The start of this fan is checked each time the door of the waste cell is opened.

8. Emergency Electrical System

The emergency electrical system which supplies emergency power to the ventilation fans and the area radiation monitors is a 50 KVA generator. The licensee is adding a second 45 KVA emergency generator.

The licensee checks the operation of the 50 KVA generator each week. At least once each six months the licensee checks the automatic start capability of the generator on loss of normal power.

9. Nuclear Safeguards Committee

The members of the committee remain those given in the letter dated August 12. 1976.

J. J. Agnesta, Chairman
D. B. Holzgraf, Senior Technical Responsible Person
J. J. McGovern, Responsible Engineer
C. J. Konnerth, Health Physicist (Secretary)
K. D. George, Consultant in Reactor Technology
F. J. Morse, Consultant in Radiochemistry and Nuclear Engineering
J. A. Ward, Consultant in Radiation Safety

The inspector reviewed the minutes of monthly meetings in which some operating procedures and health physics procedures were reviewed and approved. It appears that the Nuclear Safeguards Committee has recently recognized their responsibilities for the Hot Laboratories. However, the committee might well review these responsibilities which are given in the April 28, 1969 license application letter.

10. Annual Audit

The annual audit performed by a person outside the Nuclear Operations line organization was conducted by Mr. K. D. George. The audit was of criticality safety and was reported in a letter dated August 31, 1979.

The audit disclosed no problems requiring correction.

11. Training

Since Inspection 79-05, the licensee conducted evacuation drills on November 3, 1979, and March 28, and June 26, 1980. The November 3, 1979 drill was for fire and subsequent evacuation. The March 28, 1980 drill used a simulation of a high radiation condition in the shipping area. The June 26, 1980 drill was an unannounced drill in which the evacuation alarm was sounded. According to licensee records, the drills were successful and useful in training personnel.

The training pamphlet entitled "Understanding Radiation" was reviewed. The Training Manual was also reviewed. This manual included: instructions for the accounting for special nuclear materials; title 10 Code of Federal Regulations Parts 70 and 73; and License No. SNM-639 license conditions.

The test results for a recent new hire was examined. The test appeared to be comprehensive. The individual scored 80 percent. The licensee considers a 70 percent score to be passing.

12. Transportation Activities

The inspector observed the radiation monitoring, labelling, and loading on a vehicle of two Model B-3 casks.

The licensee took radiation measurements from all surfaces of the casks, radiation readings at 3 feet from the surface area giving the highest radiation were taken. The casks were properly labelled with Radioactive Yellow III labels listing the amount and type of radioactive material and the transport index.

The two casks were placed on a flatbed trailer and were securely fastened to the trailer. Radiation readings were taken at six feet from the edge of the trailer and in the tractor including the sleeper area. The vehicle was properly placarded.

The radiation readings discussed above met the DOT regulations.

The shipping papers for the shipments were made out properly and included the instructions to the carrier for maintenance of exclusive use controls.

The inspector asked the carrier driver what these instructions meant, since he signed the instruction sheet without studying the instructions. The drive explained the exclusive use controls satisfactorily.

13. Exit Interview

The inspector met with the licensee representatives (denoted in paragraph 1) at the conclusion of the inspection on August 1, 1980. The scope of the inspection was presented, and the following items were discussed.

The criticality monitoring system and the fact that the system does not meet the requirements of 10 CFR 70.24(a) was discussed. The inspector made the points that: (1) All areas in which special nuclear material possessed under License No. SNM-639 is handled, used, or stored must be covered by the criticality monitoring system, (2) The monitoring system must actuate a clearly audible alarm signal if accidental criticality occurs, and (3) Personnel must evacuate upon hearing the audible alarm signal caused to sound by the monitoring system. The licensee contended that their present system meets the requirement of 10 CFR 70.24(a). (Paragraph 4.a)

The item of noncompliance in which the welding location used for welding the seconda[illegible]es on the targets was not posted with a nuclear criticality safety sign was discussed. (Paragraph 4.b)

The item of noncompliance involving the fact that the licensee was not meeting the contamination control requirements given in their license approved application was discussed. (Paragraph 5.a)

The inspector pointed out that the housekeeping in the Hot Laboratories generally appear to be good; however, the areas of the second level above the cells other than the laboratories appeared to be in general disarray. Also, there was a 55 gallon waste drum blocking the safety shower position. (Paragraph 5.b)

The fact that the disposition of the small quantities of plutonium in the uranium waste form process was discussed. The licensee indicated they would study this situation. (Paragraph 6)