

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

REGION V

Report No. 50-139/80-04  
Docket No. 50-139 License No. R-73 Safeguards Group \_\_\_\_\_  
Licensee: University of Washington (Nuclear Engineering Laboratory)  
Seattle, Washington 98195  
\_\_\_\_\_  
Facility Name: Nuclear Engineering Laboratory Reactor  
Inspection at: Seattle, Washington  
Inspection conducted: July 18-22, 1980  
Inspectors: *F. A. Wenslawski* 9/3/80  
J. R. Curtis, Radiation Specialist Date Signed  
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Date Signed  
Approved By: *F. A. Wenslawski* 9/3/80  
F. A. Wenslawski, Chief, Reactor Radiation Safety Sect. Date Signed  
Approved By: *H. E. Book* 9/3/80  
H. E. Book, Chief, Fuel Facility and Materials Date Signed  
Safety Branch

Summary:

Inspection on July 18-22, 1980 (Report No. 50-139/80-04)

Areas Inspected: Routine, unannounced inspection of the Radiation Controls, Environmental Protection, and Emergency Planning programs, including a tour of the facility, discussions with licensee representatives, and examination of personnel monitoring, survey and material transfer records. The inspection involved 17 hours on site by one NRC inspector.

Results: No items of non-compliance or deviations were identified.

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## DETAILS

### 1. Persons Contacted

\*Professor W. Chalk, Director  
Mr. P. Miller, Assistant Director, Operations  
\*Mr. D. Fry, Assistant Director, Support  
Mr. Scott Swoope, Reactor Operator  
Ms. Kathy Swoope, Radiation Safety Monitor  
Mr. M. O'Brien, U.W. Campus Radiation Safety Officer  
Mr. W. Thomas, U.W. Campus Health Physicist

\*Indicates presence at the exit interview.

### 2. General Operations, Tour

The reactor operates on a weekly schedule of moderate use that varies depending on the University's scheduling of courses that utilize the reactor, the demand for neutron activation runs, and requests to run other reactor experiments by researchers. The inspector did not observe reactor operations; the inspection occurred when a national professional conference (Health Physics Society) was being held in Seattle and much of the staff participated or attended this conference. The inspector toured the facility and discussed current and recent projects with staff members when they were available.

During the tour, access control, posting and labeling, housekeeping, and air sample and area monitoring techniques were observed and discussed; experimental facilities for routine sample irradiations and post irradiation handling were examined as were facilities for a special experimental set up for studying the interaction of neutron flux and fluid phase changes, called NODAR.

No items of non-compliance or deviations were identified.

### 3. Radiation Protection Program

The Assistant Director for Operations is responsible for day-to-day operations of the reactor, supervises the reactor operators and schedules and approves experiments and neutron activation runs. The radiation safety aspects of operations are usually discussed at weekly or daily scheduling meetings with the scheduled reactor operator. Close contact and coordination between the Assistant Director and operators and experimenters is a basic part of the radiation safety program at the reactor. A Health Physicist from the campus Radiation Safety Office participates in the discussion and approval of experiments and examines and evaluates the radiological safety aspects. A Radiation Safety Monitor is assigned from the Campus Radiation Safety Office to perform routine and special surveys, perform laboratory analyses of air and swipe survey samples and perform other routine radiation safety functions such as special monitoring, film badge exchange and radioactive waste pickup on an as needed basis.

No items of non-compliance or deviations were identified.

#### 4. Personnel Monitoring, Operations and Radiation Survey Records

Personnel monitoring and radiation survey records were examined for the period January 1979 to June 1980. Personnel exposures are low, in 1979 reported annual exposures were in the 0 to 30 mrem range, records available to date in 1980 show one experimenter with 50 mrem to date and the other six or seven persons who are issued film badge dosimeters on a routine basis are in the 0 to 30 mrem range.

Irradiated samples from neutron activation and radioisotope production are surveyed on removal from the reactor and prior to extensive handling, transfer or release from the facility. Radiation levels recorded in sample monitoring surveys ranged from tenths of millirem per hour at the surface of some to 350 to 700 millirem per hour at 12 inches distance in a few runs for Sodium-24 production in millicurie quantities.

It was noted that for sample irradiations resulting in dose rates of up to 700 millirem/hr at 12 inches, there was no evidence that extremity dosimeters were immediately available or that extremity doses were monitored. The use of extremity dosimeters and close-in radiation measurements for assessing exposure when handling moderate to high dose rate samples, such as millicurie quantities of Sodium-24, was discussed at the exit interview. Remote handling methods and shielding are used to reduce exposure in the infrequent cases of production of millicurie quantities of radionuclides, however the value of a positive method of extremity dose assessment in these cases was noted by licensee management.

Routine radiation surveys of radiation levels, surface contamination levels and airborne radioactivity are conducted on daily and weekly schedules. Examination of samples of the survey records showed that general radiation levels in the reactor facility were 0.1 to 10 millirem/hr beta gamma with some levels of 10 to 50 millirem/hr near experimental apparatus or sample irradiation facilities. These were posted with signs and barriers. The highest general levels were associated with 95 to 100 KW power runs of the NODAR experiment and special surveys, surveillance and precautions were utilized during these runs.

Surface contamination levels and airborne radioactivity levels were low, slightly in excess of background levels occasionally, for surface contamination, and levels of  $< 2 \times 10^{-14}$  alpha and  $< 2 \times 10^{-13}$  micro-curies beta activity per milliliter of air were typical of air samples taken in the reactor room.

A neutron survey meter is available and neutron surveys are performed when appropriate. Scattered neutron dose levels of 1.5 to 18 millirem/hr were measured and reported in a special survey of the top deck of the reactor (roped off with a barrier rope) during a full power run of the NODAR experiment. Personnel access to this area was severely controlled.

No items of non-compliance or deviations were identified.

## 5. Radioactive Material Transfers

Examination of records of irradiations in the reactor operations log book indicated that there were thirty transfers of radioactive materials in 1979 and approximately fifty to date in 1980. All transfers are made to or through the university's state license to university researchers or outside institutions who file their authority to possess radioactive materials with the Campus Radiation Safety Office. In a limited number of cases researchers also provide the reactor staff with copies of the authorizing documents. Administrative control appeared adequate based upon examination of the records available at the facility.

No items of non-compliance or deviations were identified.

## 6. Effluent Monitoring

Gaseous effluent is released via a stack that is monitored for gaseous and particulate activity. Rate meter readouts for these monitors are located at the reactor console. The particulate filter is exchanged periodically or is changed if an unexpected rise above the normal range occurs. The licensee representative indicated that there were none of these in the recent past. The air in the reactor room is sampled for particulate activity at three separate locations. One sample is changed and analysed daily and the others on a weekly schedule. Review of the results of these sample analyses showed levels of  $< 2 \times 10^{-14}$   $\mu\text{Ci/ml}$  gross alpha and  $< 2 \times 10^{-13}$   $\mu\text{Ci/ml}$  gross beta activity, in the expected normal background range.

Argon-41 releases are monitored and quantified via the stack gas monitor. The rate meter and an integrator are located at the console where the operator maintains surveillance during operations. The Radiation Safety Monitor records the integrator value each day the reactor operates and determines the Argon-41 release based on the difference in count between readings and an efficiency factor determined by semi-annual calibration. The last calibration was performed May 1, 1980.

Examination of selected samples of records of Argon-41 releases indicated that values for daily release ranged from 510  $\mu\text{Curies/day}$  at  $2$  or  $3 \times 10^{-11}$   $\mu\text{Curies/cc}$  average concentration, to 515 millicuries/day at  $2.3 \times 10^{-8}$   $\mu\text{Curies/cc}$  average concentration. The low end of the range reflects the integrated count on days when little or no reactor operations take place and is a conservative value that is principally the background counts that are not subtracted in the calculation. The high end of the range was represented by reactor operations at 95 KW power for runs of the NODAR experiment over a three to eight hour period, these runs are not typical and the calculated daily average concentration does not exceed the 10 CFR 20 or technical specification limit.

The reactor facility has a hot drain and liquid waste system with a hold-up tank. The activity in the wastes has been low, in the  $10^{-9}$   $\mu\text{Ci}$  per ml. range, and relatively small volumes are released. The last release of radioactive liquid waste was 1,440 gallons containing 0.015  $\mu\text{Ci}$ , or  $2.7 \times 10^{-9}$   $\mu\text{Ci/ml}$  of activity, released to the sewer on 2-14-1980 after sampling and analysis. The previous release of 1,440 gallons was 6-12-1979, containing 0.012  $\mu\text{Ci}$  at  $2 \times 10^{-9}$   $\mu\text{Ci/ml}$  concentration.

No items of non-compliance or deviations were identified.

7. Environmental Monitoring

The licensee has mounted a series of sixteen film badges and TLD dosimeters at the outside perimeter of the reactor facility and four on the walls of the reactor room to monitor external radiation levels in these regions.

A TLD and Pressurized Ion Chamber study was performed to monitor environmental levels in mid-1978. Instrument readings were in the 6 to 15  $\mu\text{r/hr.}$  range with the reactor at 90 KW and 6 to 8  $\mu\text{r/hr.}$  with the reactor not operating. The range reported for the TLD was higher, 10 to 30  $\mu\text{r/hr.}$ , but well within the limits imposed by 10 CFR 20.105, Permissible Levels of Radiation in Unrestricted Areas.

The results of the April 1980 film badge/TLD study were examined. The range of doses reported for the period at the sixteen locations was from "less than minimum detectable" ( 10 millirem) to 70 millirem. Licensee representatives stated that these April levels were atypical, they reflected a higher reactor use factor and an unusually higher dose rate factor at some peripheral locations. Extended and frequent runs of the NODAR experiment were conducted in the last half of April. The licensee representatives were alerted to the limits on average radiation levels for unrestricted areas as specified in 10 CFR 20.105. They pointed out that this type experiment is not run on a regular monthly schedule and special radiation level surveys are performed in conjunction with scheduled runs to ascertain that radiation levels are within limits.

No items of non-compliance or deviations were identified.

8. Emergency Planning - Drills

The licensee conducts emergency response drills and provides familiarization tours of the reactor facility for the University Police. The last emergency drill was held in September of 1979 when communications systems and response times for the Campus Radiation Safety Office were exercised. The licensee reported that the response time was about two minutes after the call and was adequate. The licensee representative reported that facility personnel did not evacuate the building for the drill but assembled and reviewed the Emergency Response Procedures.

No items of non-compliance or deviations were identified.

9. Licensee Response to IE Bulletins, Circulars

- a. The licensee responded to IE Bulletin 79-19 in a timely manner. The generation, collection and handling of radioactive wastes was discussed and disposal and transfer records were examined.

Solid waste is accumulated in plastic-lined, labeled boxes. When full, these containers are sealed, surveyed and analysed to identify and quantify the radioactive content. The sealed containers are transferred to the University Radiation Safety Office for storage and final packaging for disposal via the University's state license. The volume and radioactive content of the waste is small, the transfers are infrequent. The last two transfers were less than 100 microcuries

each and consisted of two 2.5 Cu. ft. boxes in April 1980, and four 2.5 Cu. ft. boxes and one 55 gallon drum in November 1978. Liquid waste is collected and stored in a hot drain/hold up tank system. The tank contents are periodically sampled, analysed and if within limits are released to the sewer. The records of the last two releases indicated that 1,440 gallons containing less than one microcurie was released February 1980 and a similar volume containing less than one microcurie released in June 1979.

Facility operations are on a laboratory scale. There are no routine operations involving generation or release of process liquids or large volumes of solid waste. The small staff and experimenter users are trained and supervised by the Reactor Supervisor. Precautions regarding radioactive waste generation and handling are presented by the Supervisor during training and orientation. No audits are performed.

No items of non-compliance or deviations were identified.

- b. The licensee representative had received IE Circular 80-14 and had reviewed access and possible plumbing inter-connections with potentially radioactive systems. A previous review by the University's plant service organization had been performed. Pressure differentials in heat exchanger systems were checked and back flow preventers added to potable water supplies throughout the facility. The reactor supervisor performed a re-review and considered the matter closed.

No items of non-compliance or deviations were identified.

#### 10. Exit Interview

An exit interview was held with the Director of the Nuclear Engineering Laboratory and an administrative staff member at the close of the inspection. The scope and findings of the inspection were reviewed.

No items of non-compliance or deviations were identified.