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Memorandum

TO : Eber R. Price, Assistant Director
Division of Licensing and Regulation

DATE: FEB 2 7 1964

FROM : L. Kornblith, Jr., Assistant Director
for Reactors
Division of Compliance

SUBJECT: U. S. ARMY MATERIAL RESEARCH AGENCY
DOCKET NO. 50-47

ATTN: R. G. Page

Attached is a report by our field inspector of a visit to the subject facility on January 20, 1964. No items of noncompliance were noted during the visit.

Attachment:
CO Rpt No. 47/64-1 dtd 2/7/64
by J. R. Sears

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U. S. ATOMIC ENERGY COMMISSION
REGION I
DIVISION OF COMPLIANCE

February 7, 1964

CO REPORT NO. 47/64-1

Title: U. S. ARMY MATERIAL RESEARCH AGENCY
LICENSE NO. R-65
Date of Visit: January 20, 1964

By: John R. Sears, Reactor Inspector

SUMMARY

A visit was made to the Watertown Arsenal reactor. An aluminum heat exchanger had leaked, but the secondary system activity had never approached Part 20 limits. A five foot water leg has been installed in the containment building as an overpressure relief. An interlock now prevents simultaneous fission chamber and rod movement. The annual Army inspection was stated to be an improvement over previous years. A transistorized control rod magnet amplifier has been designed but will not be installed without prior Commission approval.

No items of noncompliance were observed.

DETAILS

I. Scope of Visit

A visit was made to the Watertown Arsenal reactor at Watertown, Massachusetts, on January 20, 1964, by Willis Browne, Inspection Specialist (Criticality) and John R. Sears, Reactor Inspector, Region I, Division of Compliance. The visit included a tour of the reactor, review of reactor operational records, health physics records, and minutes of the Reactor Safeguards Committee meetings, and discussions with members of the operating staff.

Persons contacted during the visit include the following:

Mr. John O'Connor, Reactor Director
Mr. Richard Stanton, Reactor Engineer
Mr. Charles Dady, Health Physicist

(continued)

II. Results of Visit

A. Health Physics

The inspectors reviewed the records of liquid and gaseous effluents discharged from the reactor building. These indicate that the maximum concentration of gaseous activity released from the stack occurred during the period October 7 - 14, 1963, when the concentration reached a level of 3.3×10^{-6} uc/cc. This is well within licensed limits for this reactor since the license now includes a dilution factor because of the 150 foot stack. Mr. Dady stated that the activity was principally due to A-41 from the pneumatic tube facility and from the slant tube facility in which the AVCO Corporation representatives were irradiating electronic components.

Radioactive liquid waste from this facility is normally discharged to one of three waste tanks where it is analyzed before it is discharged to the Metropolitan District sewer system. It is also possible to discharge waste first to an underground concrete holdup tank before sending it over to the regular waste tanks. The records indicate that the discharge to the Metropolitan District sewer over a period of one year amounted to 167,000 gallons of liquid which contained 1,017 uc of activity. From the beginning of operations of this reactor on June 21, 1960, there has now been a total of 574,500 gallons of liquid waste discharged which contained a total of 1,677 uc of activity. Mr. Dady stated that the principal source of high level waste occurred during the regeneration of the ion exchange column on the primary coolant system. About 200 gallons of waste water are accumulated during the backwash cycle of the regeneration process. Normally, this water is discharged to the underground tank and the activity is allowed to decay for a period of a few months before it is sent to the waste tanks. It is then analyzed for radioactivity and diluted with other discharge water before it is finally discharged to the sewer system.

The inspectors reviewed the records of personnel exposures. The maximum exposure accumulated by any person since the start of this facility has been 980 millirem received by Mr. Dady, the Chief Health Physicist.

B. Heat Exchanger

The heat exchanger for primary coolant is of all aluminum construction. The primary water is on the tube side and the secondary water on the shell side. The secondary water comes from any of three different sources - from the Arsenal's own well, from the city water system, or from a combination of the two. The secondary water system does not appear to be a very pure system. During the past year there have been a number of tube failures in the heat exchanger. For a while, these tube failures were handled by plugging up the end of the tube sheet with an epoxy resin plug. Finally, the whole tube bundle was replaced. The inspectors examined

(continued)

Results of Visit (continued)

the old bundle. It appeared to be full of crud and corrosion products and there was a heavy coating of black crust on the outer ring of the tubes. The possibility exists that this coating was so heavy that the flow velocity was increased in this area and that some of the tubes may have eroded because of the high flow. Mr. O'Connor stated that he is sending the old bundle for examination by Watertown Arsenal metallurgists in the hope that they will come up with some answer as to what sort of water treatment should be employed on the secondary side. At the present time, the treatment on the secondary side consists solely of a screen to keep out large objects. The secondary water discharges directly to the Charles River. Normally, there is only background level activity in this discharge. Mr. O'Connor said that a 30 ml gross water sample is taken and analyzed every morning by their reactor operations crew. Every Monday morning a 1,000 milliliter sample is evaporated to dryness for a more accurate determination of any activity. If the daily gross water sample indicates an increase in activity level, a larger sample is taken immediately. The inspectors reviewed the records of the samples which were taken at the time of the leaks in the heat exchanger. They indicate that there were no discharges to the river above the limits of Part 20.

During operation, the secondary side of the heat exchanger operates at a slightly higher pressure than the primary side so that if there is a leak, it would be into the reactor pool rather than the other way.

Normal activity level in the primary coolant is 2×10^{-6} uc/ml when the reactor is shut down. Over the weekend, the secondary pumps are shut down. Primary system pressure is then higher due to the head of water in the reactor pool and the location of the heat exchanger in the basement. Monday morning secondary water analysis would thus indicate a leaking tube.

Mr. O'Connor is considering changing the system so that the flow of the secondary water is through the tubes rather than through the shell side. This would allow for easier cleaning of the tubes of any accumulation of corrosion products. Another solution being considered is the installation of an all stainless steel heat exchanger.

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Results of Visit (continued)

C. Army Inspection

Mr. O'Connor stated that the facility had been inspected during June 1963 by the Corps of Engineers. The inspection team this year consisted of five people. Mr. O'Connor thought that the inspection this year was a better inspection than in previous years when the team had consisted of fourteen and nine men. He said one of the items that they had picked up was something his own staff was aware of, but simply had not gotten around to rectifying. A two-inch air line enters the containment building to furnish compressed air at 50 pounds/square inch to various experimental facility stations. This line is also used to pressurize the containment shell during the containment test. The possibility exists that, over a weekend when no one is in attendance inside the building, a malfunction to this compressed air line could occur and pressure above the design limits of the containment shell could build up. Mr. O'Connor said that it takes about six hours to pump up the building for a containment test. A five foot water leg has now been installed in the building to act as a relief valve in case of overpressure.

D. Reactor Safeguards Committee

The inspectors reviewed the records of meetings of the Reactor Safeguards Committee since the last reactor inspection visit. Meetings had been held in May, June, September, and November 1963. Approval was given for installation of the slow chopper, and for a new fire emergency procedure, and for a series of activation analysis irradiations. These records indicate that an adequate analysis of potential hazards is made by this committee before experiments are performed in or on the reactor. The records do not indicate that this committee does an internal audit sort of inspection. The latter point was discussed with Mr. O'Connor who stated that this is done by yearly visits of Dr. Robert Cochran of the University of Texas.

E. Reactor Operations Records

The inspectors reviewed the console logbook. The only unusual occurrence uncovered during the review occurred during a reshuffling of fuel elements during the late fall of 1963. According to the logbook, during the movement of fuel there had been a period scram. This was discussed with Mr. O'Connor who stated that it is the normal practice to make any fuel or reflector changes in the core with the safety rods cocked. The operator had moved a handling rod holding a fuel element too close to the Log N - Period chamber and the scram resulted. Mr. O'Connor said that there has never been a real period or high level scram.

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Results of Visit (continued)

F. Miscellaneous

During the visit, the reactor was shut down, and the control room was manned by a licensed operator who demonstrated to the inspectors that an electrical interlock now prevents simultaneous control rod and fission chamber movement.

A discussion was held with Mr. Richard Stanton on his design of a transistorized control rod magnet amplifier. He said that he had not as yet completely analyzed the reliability of the circuit when one considers that each transistor may fail in either the open or short condition. Mr. Stanton demonstrated the operation of the circuit in a bench test. He said that he will not install the circuit in the reactor system without approval of LR, and will furnish LR with complete information on the design when his reliability analysis is complete. The design does not include a means of making periodic tests. Stanton also said that he prefers the word "efficiency" of a system rather than reliability, and that true efficiency depends upon an adequate preventive maintenance system. He regularly replaces safety system amplifiers on a three-month basis and usually finds that some component in the discharged amplifier had started to go bad.