

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

August 14, 1967

CO REPORT NO. 46⁷/67-2

Title: U. S. ARMY MATERIALS AND MECHANICS AGENCY -
WATER TOWN ARSENAL
LICENSE NO. R-65
Date of Visit: July 20, 1967

By : J. R. Sears, Reactor Inspector

*J.P.O. Reilly
for*

SUMMARY

This reactor is shut down for modifications for uprating to 5 Mw. Exposures and contamination have been held to a minimum during the work.

A continuing training program for operators is in force.

The Safety Committee continues to be active.

Watertown Arsenal personnel have been reduced in force but the new agency, U. S. Army Materials and Mechanics Agency, intends expanding the professional staff.

For 5 Mw operation, an emergency core spray is being installed, and regeneration of the ion exchange column will be automatic.

The new Commanding Officer endorses limited participation of the reactor staff in a reciprocal audit program with other research reactor operators.

No violations of the Federal Regulations or of the operating license were observed during the visit.

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DETAILS

I. Scope of Visit

A visit was made to the Watertown Arsenal reactor of the U. S. Army Materials and Mechanics Research Agency (ARMMA) at Watertown, Massachusetts, on July 20, 1967, by Mr. J. R. Sears, Reactor Inspector, Region I, Division of Compliance. The visit included a tour of the facility, review of operating and health physics records, and discussions with the following:

Colonel Kellogg, Director of ARMMA
Mr. Jack O'Connor, Reactor Director
Mr. Charles Dady, Health Physicist
Mr. Leo Foley, Health Physicist
Mr. Joseph Vella, Reactor Operator

II. Results of Visit

A. Tour of Facility

The inspector toured the facility with Mr. O'Connor. The reactor had been shutdown for some time and modifications are being made for upgrading the reactor to 5 Mw. The reactor tank has been completely drained of water and the core and the control rods have been removed. They were observed to be stored in the water filled gamma facility in a pit in the basement. A second cooling tower has already been installed and the two new heat exchangers and circulating water pumps were observed to be on-site and ready for installation. Installation of the concrete shielding walls around the primary coolant heat exchangers and pumps was observed to be in progress in the basement. No changes have been made as yet to the reactor console. Mr. O'Connor said that the remote area monitoring system and the Log N-Period system will be changed from a vacuum tube to a transistorized system. Mr.

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Results of Visit (continued)

O'Connor also stated that he expects that the neutron detecting chambers will be linear at 5 Mw, though their position in their guide tubes may have to be changed. The inspector observed that they are making some changes to the shielding around the beam tubes to make it more compact.

The inspector observed that the air exhaust system has been modified so that the final element before the duct work discharges to the stack is now a fan. This places the absolute filters under suction whenever the fan is operating.

Mr. O'Connor stated that in preparation for 5 Mw operation and for reconstitution of the core after this extended shutdown, he is preparing detailed written procedures for loading and for initial test runs. He said that he hopes that the reactor will be ready for reloading in September or October.

B. Personnel Training

Mr. O'Connor showed the inspector a written series of questions which are used as a continuing refresher course for the operators. Mr. O'Connor said that these questions are answered in open book style. The operators can work together or they can look up material in manufacturer's or operations manuals or in hazards reports. The only requirement is that an operator may not simply copy the answers of another operator. Mr. O'Connor said that in this way he gets the operators to work together and that regardless of where or how they dig out the information, he has found that they learn from the process.

C. Absolute Exhaust Filters

Mr. O'Connor stated that he still has no concrete plans at the present time for testing the absolute exhaust filters

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in-place. He is considering borrowing a DOP testing kit from an Army installation in Washington, D. C. However, he hesitates to start such a program because he already has to replace his filters because of pressure drop due to dust buildup every three to six months. Logically, he would then have to test the new filters every three to six months. The inspector pointed out that even the Safety Committee has expressed reservations about the efficiency of these filters. Mr. O'Connor rebutted that he does not take credit for these filters in coping with the maximum critical accident.

Both he and Mr. Dady did say that they intended recalibrating the stack gaseous monitor in preparation for 5 Mw operation.

D. Audit

Mr. O'Connor stated that Dr. Cochran of Texas A&M is still a consultant to the reactor staff. He reviewed their submittal to the AEC of their safety analysis report for 5 Mw operation. He has not performed an on-site audit, however, for the last year or two. Mr. O'Connor said that they are visited regularly by two different groups of inspectors from the Army - one from the Inspector General's Office and another from Materials Command - and this takes quite a bit of his and his staff's time. He said that it was his understanding that the Army is not insisting upon a physical inspection of the reactor before it proceeds to 5 Mw.

E. Fire Alarm

The inspector has observed that the main reception building at the main gate had been closed and was surrounded by a cyclone fence. Mr. O'Connor said that this was in line

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Results of Visit (continued)

with the economy move of cutting down personnel that are no longer needed and he said the Arsenal no longer has its own fire department. The fire alarm system in the reactor building is being wired to the City of Watertown's Fire Department. The reactor pool water level alarm will go to the guard's shack on site where there is a list of reactor people to be called in case of emergency.

F. Emergency Spray

Mr. O'Connor said that the 5 Mw reactor will have an emergency spray system which will consist of a pipe with a shower head located near the top of the reactor tank. This will discharge water onto the core in the event of a complete loss of coolant. He said that periodically they will test this system by disconnecting the pipe to the shower head and checking whether water discharges from the pipe upon the appropriate signal. The inspector pointed that this does not truly test the most important part of the system, the shower head. Mr. O'Connor agreed that this was true. The inspector suggested that they may wish to consider having this spray head on-line all the time feeding from their regular primary coolant recirculating system with an emergency tie-in, by an emergency signal, to a fire water system or a special reserve water system. Mr. O'Connor stated that he would consider such a system.

G. Ion Column

The inspector observed that a new ion column will be installed with the new heat exchangers. Regeneration of this ion column will be completely automatic except for the filling of the two regenerate tanks with acid and with caustic. Once this is done, the operator simply pushes one button and the valving and the sequencing of operations is then done

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Results of Visit (continued)

automatically. Mr. O'Connor stated that the reason for automatic operation was that he had found that operators required different amounts of backwash water. One operator used as much as 200 gallons water more than another. This was becoming an economic burden since this water had to be processed before being disposed of.

H. Health Physics

The inspector reviewed records on surveys taken and on personnel exposures during the present shutdown. During this review, no violations of 10 CFR 20 were observed. Mr. Dady said that during the initial work by the reactor staff, the maximum exposure to any staff member was a total of 200 mr. The fuel had been discharged from the core into a lead cask which had been lowered into the reactor tank under water. During the removal of fuel and control rods and their transfer to the gamma shielding tank, exposures were held below 10 mr. The exposures gotten by the reactor staff came about after the reactor tank was emptied of water when the reactor staff went down into the pool in order to unbolt and remove the beam tube extensions.

A local contractor who regularly does welding work is presently employed in modifying the beam tubes. The beam tubes formerly had an extension from the shield wall up to the core, which bolted onto a flange. The flange was welded to a pipe embedded in the concrete shield. The contractor's men are presently burning off the flange connection. The new beam tube will consist of a tube closed at its inner core end, and flanged at its outer end. The flange will be sealed and bolted to the outer shield wall. When a beam tube extension is to be removed, it is unbolted at its outer end and pulled back. Mr. O'Connor showed the inspector drawings which

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Results of Visit (continued)

indicated that there will be a tight fitting elastomer gasket at the inner end of the shield around the beam tube extension. This will insure that leakage is minimized as the tube is inserted or withdrawn. Furthermore, there will be a flapper valve located above the tube which will close on the inside of the reactor tank when the tube is removed. Mr. O'Connor stated that there may be some slight leakage of pool water during the operation of discharging a tube. He said that he did not expect that installing a tube will entail much leakage owing to the combination of the gasket and flapper valve.

The inspector had observed that a constant air monitor, for both particulates and gases, was employed to monitor the atmosphere in the area where the contractor's men were burning off the flanges. The air monitors have recorders and alarms. Mr. Dady showed the inspector records which indicated that the air concentration for unidentified radioisotopes during the worse conditions was about a factor of 10 over the maximum permissible concentration specified in Part 20. The records also showed that the operator was employed in burning off the flanges for a maximum of about 15 minutes at a time. Mr. Dady also pointed out that there was only one man doing this work. The man is a scuba diver by avocation who had no objection to wearing a Scott air pack all of the time that he was doing the burning. Mr. Foley stated that any time any of the contractor's people were doing work where there was the possibility of contamination or direct radiation, they were covered by a health physicist being present. He said that contractor's people are equipped with decontamination clothing, coveralls, shoe covers, and head covers. He said that he has regularly checked hair and eye brows after they worked in the reactor tank for any traces of contamination to insure that contamination was not brought off-site. He also said that these people regularly take a shower before they leave work.

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Results of Visit (continued)

The inspector's review of the records indicates that the contractor's people have been working between two and three weeks on this job and that the maximum anyone has received so far is 100 mr/week. Mr. Foley said that they will be held to a maximum exposure of $1\frac{1}{2}$ rads in 13 weeks. So far no attempt has been made to get their previous exposure history. He said that this would probably not be too difficult, since this is the first time they have ever worked with anything radioactive. He emphasized that, because of this, they had complete health physics coverage all the time that they are doing any work in a radiation area.

I. Pool Lining

The inspector had observed that stainless steel vertical channels have already been installed on the side of the pool annulus. Mr. O'Connor said that the stainless steel sheets which will line the pool and the annulus will be welded to these channel sections. The channels are held to the concrete by studs which have been driven into the concrete with a stud gun. The stainless steel sheets will be welded to the ends of the beam tube liners.

The inspector had observed that the reactor was completely emptied of the core structure and of water. The top of the reactor pool was completely covered. Mr. O'Connor said that airborne contamination was being held down by virtue of the fact that the beam tube holes were empty and the regular exhaust system, which exhausts the atmosphere from over the water level in the reactor tank, was discharging about 100 cfm through the filters and up the stack, thus pulling a vacuum on the empty beam tubes.

The inspector reviewed records of swipes and smear tests taken during the shutdown work. The highest level was about 100 cpm on the floor directly under a beam tube. Mr.

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Results of Visit (continued)

Dady said that evidently some contamination had walked along the inside of the tube. A good mopup and a check of all of the beam tube ends held down the spread of this contamination.

J. Safety Committee

The inspector reviewed records of meetings of the Safety Committee. There had been a number of meetings at which the Committee reviewed the Safety Analysis Report for 5 Mw operation. They had reviewed and approved the methane-cooled experiment of Dr. Antal. The Hazards Analysis for this experiment stated that the generation of an explosive mixture was incredible. Total evaporation of the liquid would give a negative ramp of reactivity. Flooding of the void, which would necessitate rupture of the can, would result in an addition of reactivity of less than 0.25% delta k/k.

K. Interview

The inspector held an interview with Mr. O'Connor and Colonel Kellogg, the Commanding Officer of the installation. Mr. O'Connor had informed the inspector that Colonel Kellogg has a Ph.D. in nuclear physics and has a very strong interest in basic research. Colonel Kellogg pointed out that the new initials of the Watertown installation is ARMMA (Army Research Materials and Mechanics Agency). The agency will be doing research not only in materials but also in applied mechanics. The center intends employing about 300 more scientists and supporting people.

The inspector pointed out that he had no serious problems in operational safety to discuss with Colonel Kellogg and that he always felt that the reactor was being operated safely and that it would be operated safely in the future.

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The inspector attempted to sell Colonel Kellogg on a round robin or reciprocal audit system. This is a program which the inspector has been discussing with small research reactor operators in the northeast for some time. At the July 1967 meeting of the American Nuclear Society Operations Division there were plans for bringing such a program into being. Mr. O'Connor said that he was aware of this program and that he had been approached to become part of it. He would volunteer to be an auditor over someone else's reactor; however, he hesitated to volunteer to have his reactor looked at by other operators. His reason was that the Watertown reactor is already over inspected by Army people. He stated that some of these Army people are not too competent or knowledgeable. Colonel Kellogg reinforced Mr. O'Connor's statement by saying that he has approached his superiors in Materials Command with the plea that all of the inspectors from the Army would come at one time. He would voluntarily shutdown the reactor for two weeks and then brief them all on exactly what ARMMA is supposed to be doing and how they were going about it and how they performed their day-to-day jobs. He thought that in this way that he might save quite a bit of people's time and effort. He said that he got nowhere in voicing such an idea to the Army and that there appeared to be a right way, a wrong way and an Army way. He said that he fully endorsed the Compliance Division program of sending one knowledgeable man who takes up only the amount of time necessary to make an honest appraisal of whether or not a machine is being operated safely. He thought that this was a good program and it shouldn't be diluted by too many rules and regulations. This is one of the reasons, he said, that he might welcome an audit by other research reactor operators if it were on an informal basis. In his opinion, any time such programs got formalized and put down onto a lot of pieces of paper with manuals and

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checklists and audits of the auditors, that it immediately got to be an unwieldy sort of thing which was a waste of a lot of people's time and any good which might come out of it is lost in the welter of bureaucratic words. The inspector thanked the Colonel for his opinions and said that he hopes that Mr. O'Connor would be able to participate in the rest of the program; that possibly by visiting other machines he may pick up some useful information. Colonel Kellogg said that he has already endorsed this.