U. S. ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
COMPLIANCE DIVISION

By: John R. Sears, Compliance Division
New York Operations Office Date: November 23, 1960

Title: WESTINGHOUSE TEST REACTOR

SUMMARY

The Westinghouse Test Reactor was visited on October 26 and 27, 1960. The visit included a visual inspection of the reactor and the auxiliary equipment, including the evaporation plant for disposal of the radioactive water which had resulted from the ruptured fuel incident. An initial approach to criticality with 32 fuel elements in the core was witnessed, but the reactor did not go critical. Health physics records, operating logs, records of a containment test, records of Westinghouse fuel inspection and minutes of the Safeguards Committee meetings were examined. Discussions were held with members of the staff on training, on instrument maintenance, on fuel inspection, and general operational problems.

DETAILS

I. Scope of Visit

A visit was made on October 26 and 27, 1960, to the site of the Westinghouse Test Reactor at Waltz Mill, Pennsylvania. The inspection included a visual inspection of the reactor, the auxiliary equipment, and the evaporation plant. Records of fuel inspection were examined. Operating logs, health physics records, Safeguards Committee meeting minutes, were reviewed. Discussions were held with members of the WTR staff. The following people were contacted during the visit:

M. Schultz, Westinghouse Test Reactor Manager,
A. Pressesky, Scientific Support Section Manager,
R. Rice, Technical Operations Manager,
George Geisler, Planning and Coordination Manager,
Robert Catlin, Health Physics Manager,
Don Collins, Health Physicist,

and other members of the staff.

(continued)

B/4

II. Results of Visit

A. Fuel Inspection

Mr. Roger Rice has been responsible for seeing that good acceptable fuel elements are received from their fabricator, the Makepeace Division of Engelhard Industries at Attleboro, Massachusetts. Mr. Rice said that Engelhard had quite a bit of trouble in producing elements that were finally acceptable. As of the date of inspection, a total of some 37 elements had been inspected and received at Waltz Mill from Engelhard. The inspector examined the results of all of the quality control tests on these elements. It was the opinion of the inspector that Westinghouse has done a very thorough job of self-inspection to ensure that these are good fuel elements. Mr. Rice said that Westinghouse has had constant resident inspectors at the fabricator's plant. They have had as many as 15 men, including their own Health Physicists, at Engelhard, according to Mr. Rice. Rice said that the secret of success of getting good elements seems to be very strict quality control, and it was his opinion that at the beginning of this job, Engelhard did not have this strict quality control. There seemed to be no repeat ability in succeeding plate forming operations. One shift would make acceptable plates and the succeeding shift would not, although seemingly the same process had been employed. At Westinghouse's insistence, a very strict quality control program was initiated. This was followed by a very strict inspection, and this program finally resulted in acceptable plates.

The inspector reviewed inspection reports on chemistry samples taken of fuel cores before rolling. The Westinghouse specs said that the total uranium could be from 12½% to 13½%, with .4% maximum spread in one element. Two plugs were taken in each core for chemical analysis. A typical reading would be total uranium 89.41 grams, total U-235 weight 83.4 grams. Measurements were also taken on the core dimensions. The specifications gave a tolerance on thickness of plus or minus .001", on width a tolerance of plus .000" minus .003", and on length a tolerance of plus or minus .002".

Records of fuel plates, before bending, were examined. The inspection records indicated a space for signoff on blister test, and on fluoroscope test for core length, width and camber. Camber is defined as the orientation of the core meat within the plate. If the core should be slightly askew, this would mean that the clad width on one side might be undersized. The fuel plate thickness, which was specified to have a tolerance of .122" to .125", was checked in six places. The width was checked in two places. All plates were X-rayed. The X-ray reports had a space for edge dimension (1/16" minimum), reports on inclusions, and on homogeneity.

The inspector also reviewed the reports on finished fuel tubes. These reports had a space for brazed conditions, for dents, scratches, and braze runover; a space for length with a tolerance of plus or minus .010";

(continued)

a space for I.D. plus .003" minus .002"; a space for O.D. plus .003" minus .002"; a space for concentricity of .005" runout maximum; and another space for any scratches, gouges, nicks or dents. Tube measurements were also taken by X-ray of the length of aluminum, the core thickness, the gap between the meat.

A final inspection report of some 23 completed elements was examined. This final report had space for the total loading in the element. A typical number was 200.5 grams. There were spaces on these reports for length, O.D., seam locations in the three tubes relative to each other, recessed pins OK?, another space for visible inspection for scratches, dents, braze conditions, cleanliness, and final signoff by the Material Review Board. This Board included Engelhard's responsible engineer, Engelhard's quality control man, and the customer representative, that is, the responsible Westinghouse inspection engineer.

Every fuel tube was ultrasonically examined. The inspector was shown ultrasonic traces of some 15 tubes which had been rejected. The ultrasonic test showed up any voids in the tube. Voids would sometimes occur because of poor bonding between the clad and the meat. Sometimes this poor bonding would occur at the edge of the core meat; at other times in the upper corner of the core meat. One bonding defect was found to be a void within the meat itself. Whenever a defect showed up on the ultrasonic test, these defects were sectioned and photo micrographs were taken of the section. These photos were also shown to the inspector.

Schultz stated that he felt that as a result of the strict type of quality control and inspection that Westinghouse had employed in obtaining elements, the price of the elements would probably go up by a factor of 3. He said that their fabricator has stated that he has lost a large sum of money in furnishing these elements and wants to terminate this contract. Schultz said that if this does occur, or even whether or not it does, he will get more elements from Westinghouse Atomic Fuel Department at Cheswick, Pennsylvania. The inspector was shown results of fuel fabrication at Westinghouse AFD. As of 10/26/60, the following was noted.

Ingots Melted - 69

	Tube A	Tube B	Tube C
Fillers, machined	104	115	61
Packets, assembled	91	105	47
Plates, rolled	86	101	45
Plates, annealed	65	73	25
Tubes, formed	15	16	0
Tubes, brazed	15	8	0
Tubes, final-sized	14	0	0

(continued)

B. Safeguard Committee Meetings

The minutes of some 7 Safeguard Committee meetings since the fuel rupture incident were examined. According to the minutes of the meetings, some of the items that they had taken up were (1) the loop procedures, (2) a proposed experiment in which cadmium tubes would be put into the reactor in an attempt to get a longer fuel burnup and to run with the rods further out of the reactor, and (3) the Safeguard Committee had also completely reviewed the fuel rupture incident. Dr. Pressesky said that operating procedures for the loops are written by the Loop Group under Don Skovholt, and that these procedures are then reviewed by Technical Operations and by the Safeguard Committee.

Pressesky said that a special fuel loading procedure and a special startup procedure had been written for the initial loading and startup after the long shutdown. He said that one of the difficulties was that the source had decayed considerably. The source includes antimony-beryllium, but he felt that because of the long shutdown, this was contributing very little to the background, possibly only one-tenth of the complete background. The original polonium-beryllium source was 50 curies. By now, this has decayed by approximately 3½ half lives or a factor of 8. The original counts on the source range channels from BF_3 counters had given 120 counts per minute on channels A and B during a shutdown, but now, there was a barely perceptible indication on these channels because of the source decay. Consequently, a special procedure was written for this startup. A special BF_3 chamber was put inside the core within one of the high pressure thimbles. The Safeguard Committee insisted on consulting the two outside members of the Safeguard Committee on the startup procedure. Dr. Pressesky said that he contacted Drs. Murray and Clark for their approval on the proposed procedure, and both these people agreed by telephone that the proposed procedure was safe.

Dr. Schultz later described the cadmium tube experiment further. Approximately 12 cadmium tubes are presently being fabricated by NUMEC. These tubes will be made of aluminum and will be plated with approximately 1 mil of cadmium. An aluminum sleeve will then be forged over the cadmium. This will ensure that the cadmium does not plate off and get into the primary coolant. The hope is that with these tubes placed symetrically in the reactor, the control rods will be completely out of the reactor as soon as equilibrium xenon is reached. The cadmium in the tubes will burn out over a period of the operating fuel cycle, and it is hoped that the reactor will run as a full core with the rods fully out over the whole cycle. Dr. Schultz also hopes by these means to extend the length of a cycle. However, the initial advantage would be that one operates with a full core and this should help the heat transfer problem at 60 megawatts by giving more heat transfer surface.

(continued)

C. Health Physics

Mr. Catlin said that as a result of the fuel rupture incident, the health physics organization has been strengthened. The organization now includes 24 people. Three people are assigned to the evaporation plant. The ceiling for the organization is 27 people. A safety engineer is also to be in this group.

Records of personnel exposures during the shutdown were examined by the inspector. Mr. Collins stated that the cumulative average exposure for the men actually doing the work during the shutdown was between 800 and 900 milliroentgens. The records show that some men, for example, shift supervisors, get more than this amount during the shutdown. [redacted] received 2 roentgens from April to June; [redacted] received 1.4 roentgens from April to the end of June. E.X6

Mr. Collins stated that the new head tank vent valve had been checked out by means of a source being placed next to the Kanne chamber and this actuated the valve action.

Collins also stated that the location of the sampling lines for the fission product monitor have been changed, and the response time of the monitor has now been calculated to be approximately 1/2 minute from the time activity leaves the core till it is indicated on the monitor. He said this has not been corroborated by experiments. Collins said that the Kanne chamber has not been calibrated by means of a gas. The calibration of the Kanne chamber has been done by means of a computed response. This is used as a calibration for tritium and argon at Savannah River. The reference is document DPSPU 55-11-7 of December, 1954, entitled "Response of Cylindrical Ionization Chambers To Gaseous Beta Emitters."

Mr. Dave Hosler is in charge of the evaporation plant. Mr. Hosler stated that the plant so far has only been test run and approximately 600 gallons have been put through the evaporator. He said that the water from one of the 20,000 gallon holdup tanks would go first through a filter press and then through the evaporator. It would be sampled before and after the filter press and also after the evaporator. From the evaporator it discharges into a holdup tank and then from this tank it is finally discharged into a stream where it can be diluted with other raw water before finally discharging over a weir and off the WTR site. During the test run, Mr. Hosler said that the activity of the water into the evaporator was approximately 5×10^{-5} uc/ml and approximately 1×10^{-7} uc/ml on the discharge side. He said that the paper in the filter press is presently planned to be changed weekly. He said that this paper would be expected to read approximately 25 mr/hr. This filter paper and mud from the trough under the filter press, and also the bottoms from the evaporator would be

(continued)

placed into barrels and disposed of as solid waste.

Mr. Hosler said that some of the water in the holdup storage tanks has decayed sufficiently so that it can be discharged directly by being diluted with raw water. Typical results of two such runs are included as Appendices A and B to this report. Hosler said that so far some 40,000 gallons of contaminated water have thus been discharged. Hosler said that the State of Pennsylvania had relaxed somewhat in their restrictions for discharging contaminated water. He said that if it can be proved by analysis that the water does not contain certain specific isotopes, for example strontium and radium, then the limits for discharge for unidentified emitters would be 10^{-7} uc/cc, the same as Federal limits.

Mr. Catlin later stated that there would be no vent to the atmosphere from the condenser in this evaporation plant, and that instead, the vent would go into another holdup tank which itself does have an atmospheric vent. However, this atmospheric vent is equipped with a temperature sensor which actuates an alarm and turns on a spray head. He said that the only time when any radioactive vapors might be going up this vent would be if the water in this final surge tank were to be lowered too far. In such a case, this spray in the vent line would go on, the temperature sensor would see this and would give an alarm, and the operator could then shut off the evaporator, and the whole process would stop.

It was noted during the tour of the reactor that there was on the reactor top a constant air monitor of NMC manufacture. Mr. Collins stated that this was not a moving filter paper monitor. It has a filter paper which must be replaced manually. He said that this monitor is not a gaseous detector. He continued that they are contemplating the purchase of mobile gaseous detectors to be used to monitor loop operations.

Mr. Collins also showed the inspector a hazards summary report for a byproducts material license. The application is for a broad license (from 3 to 83) and for a special nuclear material license. The inspector thumbed through this document. It seemed on a casual inspection to be very complete. The information had been compiled by Holmes and Narver. Collins said that Westinghouse has not transmitted this to the AEC for approval as yet, and they do not intend to until they find out the results of their present discussions with the Commission on their reactor license.

D. Tour of Facility

A complete inspection tour of the site was taken by the inspector in the company of Dr. Schultz. On the reactor top the installation of a fuel element into the reactor was observed. It was noted that the fuel elements were stored in a special safe geometry rack.

(continued)

During the inspection tour, work was being done on the new heat exchanger which Westinghouse is installing for 60 megawatt operation. Dr. Schultz said that during the winter it is not expected that this heat exchanger will be necessary, but it will be necessary in the summer. Schultz said that this heat exchanger had been tested out and had been noted to vibrate. He thought that the vibration was due to the fact that there was some 4 feet between tube supports in the exchanger. During the inspection, an electronic tube roller was being used to roll the tubes internally in an attempt to lock them into support plates and baffle plates. Subsequent to the inspection on Friday, October 22, Dr. Schultz reported by telephone that they had tested out the heat exchanger after the tube rolling, and the exchanger now operates satisfactorily without vibration.

It was noted during the tour that the extra cooling towers for 60 megawatt operation have been installed. During the inspection, concrete was being poured for the basement walls and the footing of the new decontamination facility building. Schultz said that the purpose of this building is to afford a place for decontamination of large pieces of equipment from the loops and also for handling the spent fuel element shipping casks. It was also noted during the tour that the concrete pipe from the reactor waste disposal building to the retention basin at the evaporation plant has been replaced with a cast iron pipe. The concrete pipe had allowed ground water to leak in, and had been filling the retention basins with raw ground water.

It was noted during the tour that the area on the reactor top had been considerably cleaned up. There is a new trough in an annular space around the outside of the top of the reactor vessel. This trough is for carrying wires to and from experiments in the vessel. These wires then travel in conduits across the space between the trough and the nozzles to the in-pile thimbles. This plan results in considerably less wiring scattered around the pile top area.

The gas loop has been installed up to the reactor top, and it was noted that the intake and discharge of this loop have been capped off and the in-pile section has not as yet been installed. The section of the loop from the read-out section to the in-pile section has been cast in shielding concrete.

Schultz stated that on high pressure water loops, rupture discs have been placed in series with the high pressure relief valves because the relief valves had been leaking, and that these rupture discs vent to the same blowdown tank into which the relief valves discharge. Schultz also stated that two thermocouples have been installed in each of the low-pressure thimbles, and these thermocouples read out on a 16 point recorder which is equipped with alarms. This is used instead of a flow

(continued)

meter to prove that there is flow to the loops during operation. Furthermore, Schultz said that these thermocouple readings are noted once an hour by a loop operator.

E. Containment Tests

In its hazards summary report, Westinghouse had stated that it would test the vapor container for leak tightness once every two years. On this basis, a test had been scheduled for May, 1961. Westinghouse decided to take advantage of the prolonged shutdown, and Schultz said they did test the containment sphere on October 19, 1960. He said that a full report of this test would be transmitted to the Commission. The inspector was shown the results of the test. These results state that the test was started at 1830 on 10/19/60 when the building was pumped up to 2½ psi. The test was completed at 1830 on 10/21/60. The building had leaked a total of 3.74% of its volume in twenty-four hours. At 2130 on 10/20, the absolute pressure in the building had decreased from 2½ psi to 1.86 psi. The leak rate in the building was determined from a calculation using a reference volume inside the building and also from a calculation using the drop in absolute pressure inside the building. The records show that during the test, the temperature was fairly constant at 27° C inside the building, while the outside temperature ranged from 56° F to 39° F. A fan was kept running inside the building in order to circulate the air and keep all levels of air inside the building at the same temperature. The calculation for leak tightness of the building was said to have taken into account all of the variables including (1) humidity in the building, (2) change in the canal level due to pressure in the building, (3) change in canal levels due to the changing pressure in the building as a result of building leakage, and (4) change in humidity due to evaporation from the canal. During the containment test, it was stated that the air lock doors had been entered a total of some 94 times. This included an entrance and exit once an hour in order to take readings inside the building.

The calculation for leak rate took into account not only the canal level due to pressure and the vapor in the building due to evaporation from the canal, but also changes in the barometric pressure. It was stated that the reference volume is on the non-leaking side of the monometer, and so does not see the barometric changes which the leaking side of the monometer sees. The reference volume consisted of four 3/4" copper tubes 80' long. They were installed vertically through the vapor container and extended up to within about 10' of the crane structure. The engineer who did the calculations stated that if a correction was not made for the canal water level and canal evaporation, this correction would amount to about 5% of the leak rate.

During the inspection tour of the facility, a number of areas had been noted where obvious leaks had been patched up. Schultz said that this patching had been done before the containment test. He said the patching

(continued)

was done by means of fiberglass tape saturated with an epoxy bituminous resin. This resin did not harden up like some plastic resins but seemed slightly pliant. Schultz felt that this resin would not crack, but would give slightly with changing temperatures.

F. Organization

Dr. Schultz stated that as a result of criticism of the organization setup at the WTR after the fuel element rupture, he has now assigned one former Shift Supervisor, Mr. Gus Taylor, as a Staff Engineer, whose job it is to ensure that there is liaison between the Technical Support Group and the Operations Group. It is Mr. Taylor's responsibility to translate into operational instructions the findings and decisions of the Technical Support Group. As may be noted in one of the appendices to this report, the special loading instruction was prepared by Freidhof and approved by Taylor & Hemmerle, and the startup instructions for the initial critical approach were prepared by Mr. Taylor and approved by Dr. Pressesky.

At the present time there is no special instrument group reporting to the Technical Operations Manager. Instead, a number of instrument technicians report to the Laboratory Services Group, and an instrument technician is them assigned to reactor instrumentation maintenance only on the day shift. When questioned about the need for more reactor instrumentation maintenance, Dr. Schultz stated to the inspector that in the future, an instrument technician would be assigned to each reactor operating shift.

There is also a new position on the staff of planning and coordinating managers. Mr. George Geisler is in charge of this work. This relieves the Manager of the WTR from many of the day-to-day scheduling headaches and the problems of expediting jobs through the shops and customer contacts concerning such jobs.

G. Reactor Startup

The reactor was initially loaded with the control rods and 32 fuel elements, and then the vessel head with the rod drives was installed. Dr. Pressesky stated that, with the poison sections of the rods in the reactor and with 32 elements in the core, he had calculated that the reactor was some 25% subcritical. The inspector noted during the tour that, as a fuel element was inserted into the reactor, an operator, stationed in the control room, observed whether there was any increase on the count rate meter.

In the thimble #6, a BF-3 counter of the type which consists of 4 chambers in parallel, each with an active length of approximately

(continued)

28 inches, was inserted, and this was tied into the regular plant instrumentation of channel A. Before any rod withdrawal commenced, channel A count rate meter was observed to read approximately 8 counts per second.

A very complete plant checkout was done before the startup. Detailed procedures had been written and were used for this checkout.

These plant checkout procedures included: (1) reactor coolant systems checkout, startup procedure #P 218; (2) the source range calibration procedure for channels A and B, #P 214 B; (3) the intermediate range calibration procedure for A and B, #P 214 C; (4) the power range calibration procedure for A, B and C channels, #P 214 D; (5) a plant pre-startup checkout procedure #P 101, which is the final check to be made immediately before startup and is done by a member of the control room staff; (6) a plant startup procedure, #P 103, used for starting up the reactor and raising its power level; (7) a loading schedule for this special run, Loading Schedule #7 A; and (8) a special procedure, #SP 103, which is a low-power criticality run for reactor operating training.

Mr. Pressesky, who is the Chairman of the Safeguard Committee, stated that all regular operating procedures, including all revisions, have now been reviewed and approved by the Safeguard Committee. In the future, all new procedures or revisions to same will be reviewed and approved by the Safeguard Committee before they are put into operation. Special procedures will require the full Safeguard Committee approval if Mr. Pressesky believes it necessary. As noted before in this report, Mr. Pressesky said that he did call on Clark and Murray, the two outside consultants to the WTR Safeguard Committee, for their approval on the startup procedure for this special run because of the question about source confidence.

During the scram checkout, it was determined that some of the console lights which indicate that the rod and the magnet are in contact would not go on. The magnet design had been changed for 60 megawatt operation due to the need for a higher magnet current because of the higher pressure drop across the core. The method of indicating contact has also been changed. The new method consists of a transistor amplifier and flip flop circuit which sees the pulse when the magnet and armature first come into contact, resulting in the lighting of a neon bulb on the console. During the checkout there was also difficulty in picking up the rods. It was first felt that possibly the rods were stripping off because of the water flow. The primary coolant flow at that time was 14,000 gpm. It was felt that this flow resulted in the pressure forcing the spring in the shock absorber on the magnet down and thus the magnet and the armature would not come into contact. The magnet currents had been checked out previously and the currents were set according to the former checkout at approximately 350 milliamps. However, it was subsequently found out that

(continued)

the previous checkout had been done with a dummy core and with such a core the pressure drop across the reactor was only 20 psi. With a regularly loaded core of 32 elements and the remaining sample baskets as in Appendix F, the pressure drop across the core is some 37 psi and so more magnet current is necessary to pick up and hold the rods. This discrepancy was finally discovered, and it was then found necessary to use approximately 415 milliamps on the magnets.

The difficulty with the magnet contact circuit could not be resolved, and it was decided to call in the technician who had done the installation and adjustment of the circuits. Normally, these instrument technicians only work days, and a man was called in specially on the midnight shift to adjust these circuits. This difficulty resulted in a delay of the startup of approximately 12 hours. Dr. Schultz admitted later that the real difficulty came down to a lack of communication between the instrument people on the setting of the magnet currents and on the adjustment of the transistor and flip-flop circuits.

Schultz stated that they had determined in tests that a few hundred milliamps in magnet holding current resulted in a difference of approximately 50 msecs in magnet release time. During the difficulty in picking up the rods, an attempt was made to pick up the rods by lowering the flow. With a low flow, there would then be a low flow cutback and scram. These signals are gotten off of the recorder, and it was necessary to jumper these circuits with alligator clip leads in order to try to pick up the rods. It was noted that the supervisor knew how to jump out the circuits.

Schultz said that the basic purpose of this first run was to establish an intercalibration between the detector in thimble #6 and the detectors on the normal plant instrumentation. Because of the source decay, it was not known whether there would be response of normal plant instrumentation. The reactor startup was finally started at approximately 11:00 a.m. on Thursday. Present in the control room were two operators and John Santavy, Shift Supervisor. Removed from the operating area, but within view of all instruments were the inspector, Schultz, Pressesky, Hemmerle, Taylor and Geisler. Schultz and Geisler plotted approach curves which were reviewed by all others present. It was noted that all operations were done strictly according to the written published procedures. Channel A, that is the special detector in thimble #6, indicated multiplication right from the first row rod withdrawal. Appendix E gives the readings of the indications on Channel A and on Channel B (normal plant BF_3) versus the various rod positions. With all rods fully out, the reactor was still not critical with this fuel loading. Dr. Schultz immediately dispatched Mr. Taylor to write a new loading procedure for the additional fuel necessary to go critical.

(continued)

Subsequent to the inspection, Schultz reported by telephone to the inspector that the reactor went critical during the next run. The next run was made with 39 fuel elements. The reactor was critical when all rods were withdrawn to 55% of full withdrawal. Schultz said that the normal plant instrumentation proceeded to give a reliable indication when the rods were 20% withdrawn. He also said that when the reactor was at 10 kilowatts the intermediate range instrumentation gave an indication of about 10 counts per second. Schultz said their present plans are to make a series of low-level testing and training runs going to a maximum of 5 megawatts. He said that when the thimble which contained the temporary BF_3 detector was pulled, another critical approach was made and the reactor then went critical at 55.1% withdrawal, indicating the thimble was worth .1%. Schultz said that formerly, with all fuel element locations loaded, an element in the furthermost outside ring was worth approximately one tenth of one per cent in k. Thus, with the reactor fully loaded with fuel and all of the rod poison sections in the core, the reactor would still be subcritical by about 2% k.

APPENDIX A

PROCEDURE AND LOG FORM FOR DISPOSAL OF WASTES BY DILUTION

Each tank of wastes which is disposed of by dilution will be discharged in a batch-wise operation which is as follows:

First process the wastes through the filter press and obtain samples on the inlet and outlet to the press. Before discharging the wastes set the raw water discharge at a predetermined flow. Record on data sheet. Then set the wastes discharge by measuring the time it takes to fill a 5-gallon bucket. This rate of waste discharge should be predetermined from calculations. Samples of the diluted wastes are collected at the weir by the automatic sampler. Before discharging wastes, be sure that the sample catch tank at the weir is empty. After discharging all the wastes from one tank, process a sample from the weir catch tank.

Record the following data for each discharge:

1. Tank No. before processing through filter press B-4.
2. Latest available determination of waste concentration 2.1×10^{-5}.
3. Tank No. after processing through filter press A-4.
4. Results of sample on inlet to press 1.6×10^{-5}.
5. Result of sample on outlet to press 1.1×10^{-5}.
6. Date of discharge 1030 10-5-60 to 1345 10-8-60 (Raw Water) 1345 10-5-60 to 134[illegible] 10-[illegible]
7. Calculated dilution water flow 33,000 gal/hr.
8. Calculated waste discharge flow 5 gal/min.
9. Results of grab samples from tank discharge 9.4×10^{-6} μc/ml.
10. Readjusted waste discharge flow 6 gal/min.
11. Volume of wastes discharged 20,000 gal.
12. Time required to discharge contents of tank 96 hrs.
13. Calculated conc. after dilution 1×10^{-7} μc/ml.
14. Result of sample from weir sample catch tank 1.06×10^{-7} μc/ml.
15. Total volume of water discharged 3.1×10^{6} gal.

APPENDIX B

PROCEDURE AND LOG FORM FOR DISPOSAL OF WASTES BY DILUTION

Each tank of wastes which is disposed of by dilution will be discharged in a batch-wise operation which is as follows:

First process the wastes through the filter press and obtain samples on the inlet and outlet to the press. Before discharging the wastes set the raw water discharge at a predetermined flow. Record on data sheet. Then set the wastes discharge by measuring the time it takes to fill a 5-gallon bucket. This rate of waste discharge should be predetermined from calculations. Samples of the diluted wastes are collected at the weir by the automatic sampler. Before discharging wastes, be sure that the sample catch tank at the weir is empty. After discharging all the wastes from one tank, process a sample from the weir catch tank.

Record the following data for each discharge:

1. Tank No. before processing through filter press *East Basin*.
2. Latest available determination of waste concentration *1×10^{-5} uc/ml*.
3. Tank No. after processing through filter press *B-1*.
4. Results of sample on inlet to press *6.5×10^{-6} uc/ml*.
5. Result of sample on outlet to press *7.0×10^{-6} uc/ml*.
6. Date of discharge *1115 to 1620 on 10-24-60 Cooling water 1105 to 1640*
7. Calculated dilution water flow ~~*20 gal/min*~~ *45,000 gal/hr*.
8. Calculated waste discharge flow *10 gal/min until 1405, then 20 gal/min*
9. Results of grab samples from tank discharge *5.0×10^{-6} uc/ml*.
10. Readjusted waste discharge flow *20 gal/min*.
11. Volume of wastes discharged *4,400 gal*.
12. Time required to discharge contents of tank *5 hrs & 5 min Tank not empty*
13. Calculated conc. after dilution *1×10^{-7}*.
14. Result of sample from weir sample catch tank *1.2×10^{-7} uc/ml*.
15. Total volume of water discharged *250,000 gal*.

SUBJECT: LOW POWER CRITICALITY FOR REACTOR OPERATOR TRAINING - Run 7A.

DATE:	REVISION NO.	SUPERSEDES
...r 25, 1...	Original	NO.: ___ REV. NO.: ___ DATED: ___

PURPOSE: To set a procedure for operation of the Reactor for Reactor Operator Training at low power levels and modified loading. This will be called Run 7A.

I. The Reactor will be loaded as per loading schedule 7A. This provides for loading 32 elements including nine control rod fuel followers. Refer to P-209 for Fuel Handling Procedure. No more than six elements may be handled loose in a group at any one time; however if an approved moveable rack or the wooden storage rack is used, ten elements may be handled if they are inserted one at a time and kept in the rack at all times until removed one at a time for insertion into the core.

II. Before start-up, make sure control room instrument setpoints are set as in Appendix A.

III. Before criticality is obtained, it will be necessary to determine source confidence. For this purpose a BF_3 chamber has been inserted into the core through shroud tube #6 (I.F. Thimble is removed). This chamber is connected to Channel A control room instrumentation. Intercalibration of regular position Channel B detector with special Channel A detector will indicate source confidence. The following steps will be followed:

1. Start withdrawing rods as per normal start-up procedure (P-103); after each 10% increment, wait at least two minutes, then record Channel A and B readings. Perform this up to 50% rod position. After each 10% movement plot the inverse counting rate from the special BF_3 detector vs rod position.

2. Above 50% rod position, move the bank in smaller increments, moving shim rod bank and safety rod bank alternately. Keep plotting the inverse counting rate and in no case exceed the rod position for criticality as determined by this curve.

3. Pull rods until the special BF_3 detector reads up to 10,000 counts/sec.

4. Note position of control rods when normal instrument (Channel B) moves off the original start-up position.

5. Intercalibrate normal Channel B - special Channel A vs control rod position for three readings up to 10,000 counts/sec. on Special Channel A detector.

6. If no reading is observed on the normal channel by the time the special Detector Channel A reads 5000 counts/sec., stop pulling rods and insert all rods to lower limits. If any changes are made a new procedure will be written to cover them.

PREPARED BY: E G Taylor
E. G. TAYLOR

APPROVED: E G Taylor for
R.B.RICE - Mgr, Tech. Oper.
A.J.PRESSESKY - ... Safeguards ...

7. If intercalibrations are obtained proceed to step IV below.

IV. After BF_3 intercalibrations are made, insert all rods to lower limits. Remove special BF_3 detector from thimble position #6 and reconnect instrument cables to regular channel A detector. Replace L.P. Thimble No. 6; connect hoses and thermocouples; establish flow through the thimble and make sure L.P. Thimble Temp. Recorder is printing properly. Check off Item VI of Loading Schedule 7-A.

V. 1. As soon as Regular Channel A detector is reconnected perform source range calibration procedure P-214B and BF_3 calibration procedure P-214A.

2. Pull rods to first intercalibration position where Channel B first began to read.

3. If no reading is seen, pull rods halfway to next intercalibration point. If no reading is seen terminate this experiment and proceed as directed. A new procedure will be governing.

4. If a reading appears, proceed to next intercalibration point and take reactor critical as per procedure P-103. Do not take power level above 10 KW until approval is received from Supervisor, Loop Operations, that the CVTR loop can take up to 5 MW operation. Shutdown reactor by cutback. No higher than 5×10^{-1} amps on intermediate range channels for 10 KW operation.

5. Continue low power startups (10 KW) until Loop approval is received as per above.

VI. When CVTR loop approval is received continue reactor startups up to 5 MW for Reactor Operator Training. This will consist of a series of reactor startups and shutdowns for training reactor operators for AEC license examinations. These will be normal startups in accordance with Technical Operations Procedures Manual except as modified herein. An occasional startup will be made with a 15 second period. During these runs take the following extra data: (To determine any fission product contamination)

a. Take a P.C. water sample every 4 hours (ion exch. in and out).
b. Read and record fission product monitor every 15 minutes until further notice.

APPENDIX A - Plant Standards for Run 7-A

A. Thermal and Nuclear Parameters:

1. Maximum deviation from the values listed in the table below or as obtained by interpolation shall be as follows:

a. Thermal Power; ± 2 MW
b. Nuclear Power; ± 2 MW
c. Inlet Temp.; ± 4°F
d. ΔT; ± 1°F
e. P.C. Flow; ± 200 GPM

PREPARED BY: E. G. Taylor

APPROVED: R.B.Rice, Mgr., Tech.Operations
A J.Pressesky, for Safeguards Subcommittee

2. The P.C. Flow must be established after loading is complete and must be that necessary to produce a pressure drop of 35PSIG across the core. The P.C. flow cutback and scram points will be set at 85% and 75% respectively of that found to give a 35PSIG drop across the core, or not less than 14,000 GPM.

THERMAL MW POWER		NUCLEAR POWER MW			INLET TEMP°F	T °F		TOTAL P.C.FLOW G.P.M.	CUTBACK CUTOUT
Normal	Alarm	Normal	Cutback	Scram	Normal	Normal	Cutback	Normal Cutback Scram	MW
5	10	5	10	15	120	2.5	6	(See paragraph 2 above)	2

B. Standard Operating Parameters

The following table lists the operating parameters that shall be maintained during operation of the reactor and/or its associated system.

PARAMETER	NORMAL VALUE	TOLERANCE	ALARM POINT	CUTBACK POINT	SCRAM POINT
Reactor Period			+6 sec.	None	+3 sec.
a. Constant Power		not less than			(below
b. Changing Power	±30 sec.	+15 sec.			2MW)
Rate of Rise of P.C. Temperatures	15°F/hr.	+2°F/hr. -5	None	None	None
L.P.Thimble Temperature	140°F	±20°F	See note	175°F	None
	NOTE: "L.P.Thimble Inst. Failure" Alarm will sound if power to the L.P. Thimble recorder fails or if a L.P.Thimble T/C burns out.				
Surge Tank Level	55%	±10%	75% Hi 35% Lo	None	None
	NOTE: P.C.Pumps stop when surge tank reaches 30%.				
Head Tank Level	89%	± 2%	93% Hi 85% Lo	None	None
	NOTE: P.C. Pumps stop when head tank reaches 95%.				

PREPARED BY: E. G. TAYLOR

APPROVED: R.B. RICE - Mgr. Tech. Oper.
A.J. PRESSESKY for Safeguards Committee

DATE:	REVISION NO.	SUPERSEDES
October 26, 1960	Original	NO.: REV. NO.: DATED:

[illegible]	NORMAL VALUE	TOLERANCE	ALARM POINT	CUTBACK POINT	SCRAM POINT
[illegible] Tank Level Controller	20"	± 1"	None	None	None
[illegible] Flow	1000 GPM	± 200 GPM	780 GPM	None	None
Ion Exchanger Flow	90 GPM	± 10 GPM	None	None	None
Reactor Building Pressure	-.65"H_2O	±.15"H_2O	-.25"H_2O -1.0"H_2O	None	+.25"H_2O
[illegible] Coolant Flow	see note	see note	10,000 GPM	None	None
	NOTE: Flow will be adjusted to keep P.C. temperatures within limits.				
[illegible] Coolant Pressure	60PSIG	± 10PSIG	None	None	None
[illegible] Tower Level	75%	± 10%	50%	None	None
[illegible] Pressure	95PSIG	± 10PSIG	80PSIG	None	None
[illegible] Water Flow	0%		25%	None	None
[illegible] Ch. Error	Alarm is sounded if variation in power range channels become greater than 6 MW.				
[illegible] Speed [illegible]	Alarm is sounded if rod drive speed regulator timer stops for 30 seconds.				

[illegible] BY: [illegible]

APPROVED: [illegible]

WTR
TECHNICAL OPERATIONS

NO. 7A

SUBJECT: LOADING SCHEDULE FOR RUN No. 7A

DATE:	REVISION NO.	SUPERSEDES S.P. NO.:
October 24, 1960		REV. NO.:
		DATED:

I. PRELIMINARY LOADING

A. Ensure that the following Control Rods and Sources are loaded as indicated. (Refer to Loading Procedure for Run No. 7 - Interim, dated 8-25-60).

OPER-ATION	ITEM	ITEM NO.	POSITION	CHECKED		INITIALS
				DATE	TIME	
1.	PoBe,SbBe Source	3	S-1			
2.	Sb-Be Source	1	S-3			
3.	Sb-Be Source	2	S-5			
4.	Control Rod	CR-1 C-45	L7-4			
5.	" "	CR-2 C-49	L4-5			
6.	" "	CR-3 C-65	L7-7			
7.	" "	CR-4 C-26	L9-3			
8.	" "	CR-5 C-13	L6-3			
9.	" "	CR-6 B-28	L3-3			
10.	" "	CR-7 D-15	L3-6			
11.	" "	CR-8 D-28	L6-9			
12.	" "	CR-9 C-58	L9-6			

B. Ensure that the following bottom entry core positions are in the specified condition

OPER-ATION	ITEM	ITEM NO.	POSITION	CHECKED		INITIALS
				DATE	TIME	
13.	L.I. Thimble	1	T1-6-6			
[illegible].	" "	4	T4-4-2			

PREPARED BY: V. E. FRE[illegible]HOF

APPROVED: R. G. Taylor for Roger E. Rice
Technical Assistant

WTR
TECHNICAL OPERATIONS

NO. 7A

SUBJECT: LOADING SCHEDULE FOR RUN NO. 7A

DATE:	REVISION NO.	SUPERSEDES S.P. NO.: REV. NO.: DATED:
October 24, 1960		

OPER-ATION	ITEM	ITEM NO.	POSITION	CHECKED DATE	CHECKED TIME	INITIALS
15.	L.P. Thimble	5	T5-2-4			
16.	" "	7	T7-8-8			
17.	BF_3 Counter	X	T6-4-8			
18.	L.P. Thimble Plug	X	T2-10-4			
19.	" " "	X	T3-8-2			
20.	Fuel Ele. Adaptor	X	T2-10-4			
21.	" " "	X	T3-8-2			

C. Ensure that the following experiments and associated fuel elements are loaded as indicated. (Refer to Loading Procedure for Run No. 7 - Interim, dated 8-25-60).

OPER-ATION	ITEM	ITEM NO.	POSITION	CHECKED DATE	CHECKED TIME	INITIALS
[illegible]	Fuel Element	C-19	L5-7			
[illegible]	BMI-SS Capsule	24-19	L5-7			
[illegible]	Inst. Fuel Ele.	C-24	L5-6			
[illegible]	Co-AL Flux Wire	1	S-2			
[illegible]	" "	2	S-4			
[illegible]	" "	3	S-6			
[illegible]	CVTR Flux Wire	1	E9-5			
[illegible]	" "	2	E8-7			
[illegible]	" "	3	E7-[illegible]			

PREPARED BY: [illegible] E. [illegible]

APPROVED: F.G. Taylor for
Roger B. Rice
Technical Assistance

WTR - FORM

WTR TECHNI . OPERATIONS

NO. 7A

SUBJECT: LOADING SCHEDULE FOR RUN NO. 7A

PAGE 3 **OF** 9

DATE: October 24, 1960

REVISION NO.

SUPERSEDES S.P. NO.:
REV. NO.:
DATED:

OPERATION	ITEM	ITEM NO.	POSITION	CHECKED DATE	CHECKED TIME	INITIALS
31.	CVTR Flux Wire	4	E6-9			
32.	" "	5	E5-10			
33.	" "	6	E4-11			
34.	" "	7	E3-11			
35.	" "	8	E2-12			

II. EXPERIMENT MOVEMENTS

A. Experiment Removals:

The following experiments will be removed from the reactor and if radiation and contamination levels permit, they will be bagged and stored in the truck lock storage cabinet. If the levels are too high the experiments will be stored in the canal.

OPERATION	ITEM	ITEM NO.	PRESENT LOCATION	NEW LOCATION	DATE COMP.	TIME COMP.	INITIALS
36.	Co-Al Flux Wire	1	S-2				
37.	" "	2	S-4				
38.	" "	3	S-6				
39.	CVTR Flux Wire	1	E9-5				
40.	" "	2	E8-7				
41.	" "	3	E7-8				
42.	" "	4	E6-9				
[illegible]	" "	5	E5-10				

PREPARED BY: W. F. FREILHOF

APPROVED: B.G. Naylor for Roger B. Rice
Technical Assistance:

WTR-FORM 3

WTR
TECHNICAL OPERATIONS

NO. 7A

SUBJECT: LOADING SCHEDULE FOR RUN NO. 7A

PAGE 4 OF 9

DATE:	REVISION NO.	SUPERSEDES S.P. NO.: / REV. NO.: / DATED:
October 24, 1960		

OPERATION	ITEM	ITEM NO.	PRESENT LOCATION	NEW LOCATION	DATE COMP.	TIME COMP.	INITIALS
14.	CVTR Flux Wire	6	E4-11				
15.	" "	7	E3-11				
16.	" "	8	E2-12				

Experiment Insertions:

There are no experiment insertions planned for this run.

III. FUEL MOVEMENTS

Loading of New Fuel Elements:

The following fuel element and basket movements will be made for Run #7A. Only those elements which have passed final WTR inspection and have been cleaned will be loaded into the core. It will be noted in the following schedule that some element numbers and their present locations have been omitted from the schedule. This information will be filled in as elements are obtained and will be transmitted to Scientific Support at the completion of the loading.

NOTE: All "V" baskets which are loaded into fuel elements, with the exception of the BMI experiment and Instrumented fuel element, will be standard "V" baskets which are left empty and installed without orifices or locking assemblies.

Remove the 2 1/2" Sample Baskets that are located in any of the following core positions. Indicate with a check mark (✓) the core positions that contained sample baskets.

NOTE: The sample baskets may be stored on the reactor top if radiation and contamination levels permit. If levels are too high the baskets should be stored in the canal until such time as decontamination of baskets can be carried out. Indicate final position of baskets, ie., canal or reactor top.

PREPARED BY: W. E. FREILHOF

APPROVED: Roger P. Rice B.G. Taylor for

Technical Assistance:

WTR
TECHNI[illegible] OPERATIONS

NO. 7A

SUBJECT: L[illegible]ING SCHEDULE FOR RUN NO. 7A

PAGE 5 **OF** [illegible]

DATE:	REVISION NO.	SUPERSEDES S.P. NO.: / REV. NO.: / DATED:
[illegible] 1960		

Operation No: 47

[illegible]	BASKET REMOVED	NEW BASKET POSITION	CORE POS.	BASKET REMOVED	NEW BASKET POSITION
			L6-8		
			L7-3		
			L7-5		
			L7-6		
			L7-8		
			L8-3		
			L8-4		
			L8-5		
			L8-6		
			L8-7		

[illegible] Completed By: ______ Date ______ Time ______

[illegible] in Restricted Areas
[illegible] to unclamp the [illegible] capsule and the instrumented fuel element to complete the following operations.

[illegible] "Lead Tube Unclamping"

Completed by: ______ Date ______ Time ______

[illegible] lead tubes to clear positions L4-7 and L5-8.

ITEM	ITEM NO.	PRESENT LOCATION	NEW LOCATION	DATE COMP.	TIME COMP.	INITIALS
[illegible] Element	[illegible]-82	[illegible] 2	L4-7			
[illegible]	1	T.I. Storage	L4-7			
[illegible] Element	C-[illegible]	[illegible] 52	L5-8			
[illegible]	2	T.I. Storage	L5-8			

[illegible] "[illegible] Clamping"

Completed by: ______ Date ______ Time ______

PREPARED BY: [illegible]

APPROVED: Roger [illegible] Rice
BS Taylor for
Technical Assistance: [illegible]

WTR - FORM [illegible]

WTR

TECHNIC. OPERATIONS

NO. 7A

SUBJECT: LOADING SCHEDULE FOR RUN NO. 7A

DATE:	**REVISION NO.**	**SUPERSEDES S.P. NO.:**
October 24, 1960		**REV. NO.:**
		DATED:

Fuel Movements in Unrestricted Areas:

OPER-ATION	ITEM	ITEM NO.	PRESENT LOCATION	NEW LOCATION	DATE COMP.	TIME COMP.	INITIALS
[illegible]	Fuel Element	C-43	FS 53	L6-7			
55.	V Basket	3	T.L. Storage	L6-7			
	Fuel Element	C-23	FS 51	L7-6			
	V Basket	4	T.L. Storage	L7-6			
	Fuel Element	B-88	FS 53	L7-5			
	V Basket	5	T.L. Storage	L7-5			
	Fuel Element	C-72	FS 52	L6-5			
	V Basket	6	T.L. Storage	L6-5			
	Fuel Element	C-71	FS 53	L5-5			
	V Basket	7	T.L. Storage	L5-5			
	Fuel Element	D-33	FS 34	L4-6			
	V Basket	8	T.L. Storage	L4-6			
	Fuel Element	D-30	FS 30	L4-4			
	V Basket	9	T.L. Storage	L4-4			
	Fuel Element	L-25	FS 29	L4-3			
	V Basket	10	T.L. Storage	L4-3			
	Fuel Element	D-37	FS 34	L5-4			
	V Basket	11	T.L. Storage	L5-4			
	Fuel Element	D-40	FS 34	L5-3			
	V Basket	12	T.L. Storage	L5-3			
	Fuel Element	D-26	FS 30	L6-4			
	V Basket	13	T.L. Storage	L6-4			
	Fuel Element		FS	L7-3			
	V Basket	14	T.L. Storage	L7-3			
	Fuel Element		FS	L8-3			
	V Basket	15	T.L. Storage	L8-3			
	Fuel Element		FS	L8-4			
	V Basket	16	T.L. Storage	L8-4			
	Fuel Element		FS	L8-5			

PREPARED BY: W. E. FREILHOF

APPROVED: Roger B. Rice

Technical Assistance:

WTR - FORM 3

WTR TECHNIC[illegible] OPERATIONS	NO. 7A

SUBJECT: LOADING SCHEDULE FOR RUN NO. 7A

DATE:	REVISION NO.	SUPERSEDES S.P. NO.:
October 24, 1960		REV. NO.:
		DATED:

OPERATION	ITEM	ITEM NO.	PRESENT LOCATION	NEW LOCATION	DATE COMP.	TIME COMP.	INITIALS
83.	V Basket	17	T.L.Storage	L8-5			
[illegible]	Fuel Element		FS	L8-6			
85.	V Basket	18	T.L.Storage	L8-6			
86.	Fuel Element		FS	L8-7			
[illegible]	V Basket	19	T.L.Storage	L8-7			
88.	Fuel Element		FS	L7-8			
89.	V Basket	20	T.L.Storage	L7-8			
90.	Fuel Element		FS	L6-8			
[illegible]	V Basket	21	T.L.Storage	L6-8			

IV BASKET AND PLUG MOVEMENTS

A. Install standard core plugs in the following core positions. Indicate with check (✓) each position that is plugged.

Operation No. 92

CORE POSITION	PLUGGED	CORE POSITION	PLUGGED	CORE POSITON	PLUGGED
L1-1		L5-10		L11-1	
L1-2		L6-1		L11-2	
L1-5		L6-11		L11-5	
L1-6		L7-1		L11-6	
L2-1		L7-10		L12-1	
L2-7		L10-1		L12-2	
L5-1		L10-7			

Operation No. 92 Completed by: ____________ Date ____________ Time ______

PREPARED BY: L. E. FREILHOF

APPROVED: Roger B. Rice (signed: R G Taylor for)

Technical Assistance: (signed)

WTR TECHN[illegible]AL OPERATIONS	NO. 7A
SUBJECT: LOALING SCHEIULE FOR RUN NO. 7A	PAGE 8 OF ____

DATE:	REVISION NO.	SUPERSEDES S.P. NO.: ____ REV. NO.: ____ DATED: ____
October 24, 1960		

B. Install 2 1/2" Sample Baskets in each of the following core positions. Indicate with a check mark (✓) each position that contains a sample basket.

Operation No. 93

CORE POSITION	SAMPLE BASKET INSTALLED	CORE POSITION	SAMPLE BASKET INSTALLED	CORE POSITION	SAMPLE BASKET INSTALLED	CORE POSITION	SAMPLE BASKET INSTALLED
L1-3		L3-5		L7-2		L9-7	
L1-4		L3-7		L7-9		L9-8	
L2-2		L3-8		L8-1		L10-2	
L2-3		L4-1		T3 8-2		L10-3	
L2-5		L4-9		L8-9		T2 10-4	
L2-6		L5-2		L9-1		L10-5	
L[illegible]-1		L5-9		L9-2		L10-6	
L[illegible]-2		L6-2		L9-4		L11-3	
L[illegible]-4		L6-10		L9-5		L11-4	

Operation No. 93 Completed By: ____________ Date ________ Time ________

V FINAL CHECKS

A. Ensure that all core positions not occupied by fuel elements or sample baskets are plugged.

Checked By: ____________ Date ________ Time ________

B. Ensure that all reflector positions not occupied by experiments are plugged.

1. A - Segment Checked by: ________ Date ________ Time ________
2. [illegible] - Segment Checked by: ________ Date ________ Time ________
3. C - Segment Checked by: ________ Date ________ Time ________
4. D - Segment Checked by: ________ Date ________ Time ________
5. E - Segment Checked by: ________ Date ________ Time ________
6. [illegible] - Segment Checked by: ________ Date ________ Time ________

PREPARED BY:	APPROVED: Roger E. Rice Technical Assistance:
W. E. FREIDHOF	B. G. Taylor for [signature]

WTR - FORM

NO. 7A

WTR
TECHNICAL OPERATIONS

PAGE 9 OF 9

SUBJECT: LOADING SCHEDULE FOR RUN NO. 7A

DATE:	REVISION NO.	SUPERSEDES S.P. NO.: REV. NO.: DATED:
October 2[illegible], 1960	1[illegible]	

D. All foreign objects removed from core and reflector, i.e. buckets, tools, etc.
Checked by: ______ Date ______ Time ______

E. All lead tubes clamped properly:
Checked by: ______ Date ______ Time ______

E. Final inspection of CVTR in-pile section completed.
Checked by: ______ Date ______ Time ______

F. All access ports in position and bolted down.
Checked by: ______ Date ______ Time ______

G. Turn on the BMI Recorder on El. 51' and ensure that each of the four (4) T/C's are printing out properly i.e. approximately 75°F.
Completed by: ______ Date ______ Time ______

H. Turn on the Data Logger and ensure that the eight (8) instrumented fuel element T/C's are printing out properly i.e. approx. 75°F. The T/C's print out from position 78 thru 85.
Completed by: ______ Date ______ Time ______

I. Turn on the L.P. Thimble recorder and ensure that the L.P. Thimble T/C's are printing out properly i.e. approx. 75°F.
Completed by: ______ Date ______ Time ______

J. Ensure that all Control Room Instrument Setpoints correspond to those established in Special Operating Procedure SP-103.

After completion of Parts I thru V, the reactor will be started and run according to Special Operating Procedure SP-103. At the completion of Parts 1, ~~and~~ 2 ~~of~~ AND 3 SP-103, the reactor will be shutdown and the BF_3 counter in T6-4-8 will be replaced with a low pressure thimble as per Part VI of this procedure and part 4 ~~5~~ of SP-103. WEF

VI. L.P. THIMBLE INSERTION

Operation No. 94 Remove BF_3 counter from T6-4-8
Note: Have Health Physics monitor BF_3 assembly when removed.

Operation No. 94 Completed by: ______ Date ______ Time ______

Operation No. 95 Insert L.P. Thimble into T6-4-8 and connect cooling lines and T/C wires.

Operation No. 95 Completed by: ______ Date ______ Time ______

PREPARED BY: [illegible]	APPROVED: Roger [illegible] Rice Technical Assistance

WTR - FORM 3

APPENDIX E

WESTINGHOUSE Test REACTOR STARTUP

Time	Rods	(Temporary) Channel A	(Normal ...) Channel B
11:17	Safety's 1, 2 & 3 at 20% withdrawal	35 counts per second	2½ counts per [illegible]
[illegible]	Safety's at 30%	42	2.6
11:29	Safetys at 40%	50	2.7
[illegible]	Safetys at 50%	70	2.7
11:45	Shims at 10%	80	3
[illegible]	Shims at 20%	95	3
[illegible]	Shims at 30%	120	3.2
[illegible]	Shims at 40%	160	3.8
	Shims at 50%	200	4.5
	Safetys at 55%	230	5
	Shims at 55%	270	5
	Safetys at 60%	300	5½
	Shims at 60%	320	6
	Safetys at 65%	350	6
	Shims at 65%	390	7
	Safetys at 70%	420	8
	Shims at 70%	470	8
	Safetys at 75%	500	8½
	Shims at 75%	520	10
	Safetys at 80%	550	11
	Shims at [illegible]	600	[illegible]
	Safetys at [illegible]%	650	[illegible]
	Shims at [illegible]	[illegible]	

[illegible] out and [illegible] supercritical. [illegible] effective [illegible]

[illegible]ately [illegible]