UNIVERSITY OF MISSOURI

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RESEARCH REACTOR FACILITY

UNIVERSITY OF MISSOURI

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REACTOR OPERATIONS

ANNUAL REPORT

August 1979

Compiled by the Reactor Staff

Submitted by

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SECTION I

REACTOR OPERATIONS SUMMARY

The following table and discussion summarize reactor operations in the period 1 July 1978 to 30 June 1979.

Total Hours Operated	7965.6
Total Hours at Full Power	7921.1
Total Integrated Power	3309.18 MWD

JULY 1978

The reactor was operated continuously during July with the following exceptions: three maintenance shutdowns on July 3, 17, 31; fourteen scheduled shutdowns for flux trap sample changes; and three unscheduled shutdowns whose dates and descriptions follow.

On July 3, a power level interlock scram occurred during the seven element pull for initial critical test on Core XX. The scram was caused by fluctuations in DPS 929 (Core Differential Pressure Transmittal) signal to the power level interlock circuitry. DPS 929 had to be reset to a different level for this portion of the initial critical test as per Reactor Test Procedure (RTP-3).

A Nuclear Instrumentation Channel 4 high power scram occurred on July 12, due to a spike on Channel 4 while switching ranges on its range selector switch.

On July 18, a Channel 4 high power scram occurred, due to operator error in switching Channel 4 range selector switch downscale during a reduction in power to 50 KW.

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The secondary low sump level cutout circuitry was upgraded in July by installing a flow shield around the low sump level cutout float switch and by installing a low sump cutout switch bypass to enable secondary pump operation if the cutout switch fails.

The initial critical test of Core XX and the Containment Building Leak Rate Compliance Check were completed in July. The leak rate was checked by a new method this year where the building was held at a constant pressure while measuring the required makeup rate. The leak rate was determined to be 11.0 scfm, below the technical specification limit of 16.2 scfm.

AUGUST 1978

The reactor was operated continuously during August with the following exceptions: three maintenance shutdowns on August 7, 14, 28; fifteen scheduled shutdowns for flux trap sample changes; and three unscheduled shutdowns whose dates and descriptions follow.

During the startup on August 1, following a maintenance shutdown, a rod not in contact with magnet rod run-in was received while pulling blade "A" due to mechanical drag caused by a blister as reported in a letter to the NRC Director of Nuclear Reactor Regulations on August 11, 1978. Control blade "B" was inspected on August 7 and control blade "C" was inspected on August 14, no blisters were found on either blade. Control blade "D" had previously been inspected on July 3, 1978, and therefore was not reinspected.

On August 3, the reactor was shutdown by manual rod run-in to repair the personnel airlock door gasket. After the door was repaired, the reactor was started up and returned to normal 10 MW operations.

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On August 26, the reactor scrammed due to a momentary loss of facility electrical power supply. No abnormalities were noted and recovery was commenced upon regaining facility power.

A new Solid State Servo Amplifier for regulating blade control was installed during August. This unit was designed and manufactured by the MURR Electronics Shop to provide a higher degree of stability and reliability than the tube type amplifier it replaced.

A new collimator was installed in Beamport "B" during August.

SEPTEMBER 1978

The reactor was operated continuously during September, with the following exceptions: fourteen scheduled shutdowns for flux trap sample changes and two shutdowns for maintenance on September 11 and September 25. There were no unscheduled shutdowns in September.

A new collimator was made and installed in Beamport "D" during September and work continued on the SANS Experiment at Beamport "B".

OCTOBER 1978

The reactor was operated continuously during October, with the following exceptions: three maintenance shutdowns on October 9, 16, and 30; fifteen scheduled shutdowns for flux trap sample changes; one scheduled shutdown for a facility evacuation drill; and six unscheduled shutdowns whose dates and descriptions follow.

On October 1, the reactor scrammed due to pool loop low flow as a result of the failure of V509 lag solenoid. This solenoid was replaced, the valve was tested and found to operate satisfactorily.

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A reactor scram occurred on October 2, due to a temporary loss of facility electrical power. This power dip was confirmed by the University Power Plant.

On October 14, a truck entry door open rod run-in occurred due to RF interference from newly run electrical leads, which caused the door 101 control circuitry to open door 101. A key enable switch was added in series with the door 101 combination lock power supply to provide sufficient isolation of the door 101 control circuitry and prevent a reoccurrence of the RF induced opening of door 101.

On October 22, a rod not in contact with magnet rod run-in occurred, rod "B" having disengaged from its magnet. Investigation revealed that blade "B" was stuck approximately 7" from being fully inserted. The offset mechanism was pulled and it and blade "B" were inspected. The blade appeared to be in satisfactory condition, but the offset was suspected to have a broken center guide tube bearing, due to seeing pieces of bearing race in the bottom of the guide tube. The spare offset mechanism was rebuilt and aligned, a new blade was placed in service, and reactor operations were continued, with the stipulation that the center guide tube bearings would be replaced with new bearings during each future offset mechanism alignment. This event was reported to the NRC Director of Nuclear Reactor Regulation in a letter dated October 31, 1978.

A rod not in contact with magnet rod run-in occurred on October 31, with all rods disengaged from their magnets. The cause of the rod run-in was later determined to be due to intermittent contacts (5-6) on the manual scram switch.

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A rod run-in due to high power on Channel 6 was received on October 31 due to operation error in control blade shimming.

A new 10 element upper Z basket was installed in October to expand our fuel storage capacity. Extensive effort was expended in support of the Nuclepore installation and testing of its irradiation facility.

NOVEMBER 1978

The reactor was operated continuously during November, with the following exceptions: two maintenance shutdowns on November 6 and November 20; fourteen scheduled shutdowns for flux trap sample changes; and five unscheduled shutdowns whose dates and descriptions follow.

On November 2, the reactor scrammed with no associated annunciation as to the reason the rods dropped. Investigation by the electronic technicians revealed that two contacts (5-6), on the manual scram switch input to the TAA's, were making intermittent contact. The switch was replaced and no further problems of this nature were experienced.

A manual rod run-in was initiated on November 2, in order to repair the inner airlock door limit switch chain.

On November 7, a Channel 5 high power rod run-in occurred due to operator error. The operator had not changed the power level set after changing the indication by pot setting of Channel 4, resulting in the indicated power increase which caused the rod run-in.

A manual scram was initiated on November 8, when pool pump 508B mechanical seal was found to be leaking excessively by an operator on routine patrol. The subsequent repair work revealed that the thrust bearing keeper nut had backed off the pump shaft, allowing the impeller to rub against the pump casing. The

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locking ring on the thrust bearing keeper nut, both bearings, the mechanical seal and the impeller were all replaced in the course of repairs.

A manual rod run-in was initiated on November 27, when the reg blade digital position indication did not respond to regulating blade movement; the regulating rod circuitry was in automatic at the time. While the reactor was shutdown, the regulating rod position indicator was corrected by tightening the drive sprocket and checking regulating rod function switches at the proper positions.

Work on Beamport "B" SANS Experiment continued in November with the installation of the vacuum chamber for SANS.

DECEMBER 1978

The reactor was operated continuously during December, with the following exceptions: two maintenance shutdowns on December 4 and 18; twelve scheduled shutdowns for flux trap sample changes; one scheduled shutdown to repair the outer airlock door bottom guide bearings; and three unscheduled shutdowns whose dates and descriptions follow.

On December 19, the reactor was shutdown by manual rod run-in during a reactor startup when the Nuclear Instrumentation indicated power was checked against a heat balance at 5 MW and N.I. Channel 6 was not indicating. This was reported to the NRC Director of Nuclear Reactor Regulations in a letter dated January 15, 1979. The inability to adjust the Channel 6 indication was found to be due to a loose amphenol connector.

On December 21, a rod not in contact with magnet rod run-in occurred, due to bumping the counterweight of rod "D" with a sample, during a sample handling evolution.

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On December 24, the reactor was shutdown by manual rod run-in to repair a ruptured fire main on the north side of the Reactor Laboratory Building, which required isolating the emergency pool fill supply line to complete the repair.

The first two fuel elements from Atomics International arrived in December. These elements were loaded in the core on December 4 and have performed satisfactorily. Additionally, a significant improvement was made in the pool heat exchangers cooling capacity. The secondary chemist, Steve Hughes, was able to achieve this by injecting air into the secondary coolant line at the inlet to the heat exchangers. The air-caused turbulance in the secondary side of the heat exchangers and resulted in the removal of much of the deposited dirt that was fouling and restricting secondary flow. Efforts are in progress to permanently install an air line to the secondary inlet to the pool heat exchangers to permit a regularly scheduled air injection as part of a preventive maintenance schedule to maintain as high a heat exchanger capacity as possible.

JANUARY 1979

The reactor was operated continuously during January, with the following exceptions: three maintenance shutdowns on January 8, 15, and 29; thirteen scheduled shutdowns for flux trap sample changes; and six unscheduled shutdowns whose dates and descriptions follow.

On January 4, the reactor scrammed due to pool loop low flow. The cause of the scram was attributed to bumping the pool flow Gemac unit, while replacing the panel protective plastic cover where it is located.

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A Channel 4 high power rod run-in occurred on January 10, due to an operator failing to switch to a higher range on the Channel 4 switch when required.

On January 13, the reactor scrammed due to a loss of electrical power to the facility. This loss of electrical power was verified by the University Power Plant.

On January 16, the reactor scrammed due to high power on Channel 6. The scram was caused by a failure of the voltage regulator module in the Channel 6 drawer. The voltage regulator was replaced, the Channel 6 drawer was checked and operations were continued.

A pool loop low flow scram occurred on January 24. The scram was due to the loss of a pool pump, P508B, which tripped while the electronic technicians were changing the open/closed indicating light bulb on the P508B breaker at MCC No. 5.

On January 28, the reactor was manually scrammed when Channel 6 indication dropped from 101.5% to 82%, with no corresponding change in power indications on any other channel. The decrease in Channel 6 indication was found to be due to a faulty DC amplifier. The DC amplifier was replaced, the Channel 6 drawer was checked and operations were continued.

Messrs. J. L. Belanger and G. M. Christoffer, N.R.C. Region III Inspectors, conducted a facility security inspection from January 22 to January 24.

FEBRUARY 1979

The reactor was operated continuously during February, with the following exceptions: two maintenance shutdowns on February 12 and 26; twelve scheduled shutdowns for flux trap sample changes; and one unscheduled shutdown.

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On February 8, the reactor was shutdown by manual rod run-in, due to a leak in the fire main supply to the reactor facility. Technical Specifications require that emergency pool fill capability be available when the reactor is operating and it is supplied by the fire main. This leak was repaired by the Physical Plant and the reactor returned to operation.

A new bouyant fuel handling tool developed by Jim Tunink was tested and used for performing a refueling in February. The tool performed well and will allow greater flexibility in refueling; since it permits refueling at normal pool levels, instead of at the refuel bridge level. This reduces radiation exposure during refueling significantly and eliminates the physical strain of handling 35 pounds at arm's length.

One maintenance day was devoted to performing reactivity verifications of shim blade "A" (RTP-11), the regulating rod (RTP-5), and various flux trap loadings (RTP-6).

Messrs. A. G. Finley and J. P. Patterson, N.R.C. Region III Inspectors, conducted a facility SNM Control and Accountability Inspection from February 21 to February 23.

MARCH 1979

The reactor was operated continuously during March, with the following exceptions: three maintenance shutdowns on March 5, 19, and 26; fourteen scheduled shutdowns for flux trap sample changes; and two unscheduled shutdowns whose dates and descriptions follow.

On March 9, 1979, the reactor was shutdown by manual rod run-in, to repair the inner airlock door support bracket. The Machine Shop completed repairs to the airlock door and the reactor was started up after refueling.

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On March 27, a pool valve 509 (Pool Isolation Valve) off open scram occurred, due to valve 509 closing as a result of a solenoid failure in the air supply to valve 509 actuator. The lead solenoid on 529V (three way solenoid valve) was replaced and V509 was tested and found to operate satisfactorily.

The "X" fuel storage basket was removed from the reactor pool in March for modification to accept a newly designed emergency fuel storage fixture. After the modification was completed the "X" basket was reinstalled in the deep pool and a test fit of the new fuel fixture was completed.

A portion of the March 19 maintenance day was devoted to performing the Nuclepore Test Procedure (RTP-16). The results of this test are being evaluated by Nuclepore at this time, in preparation for the extended Nuclepore Test which will involve operating the film irradiator for a week.

APRIL 1979

The reactor was operated continuously during April, with the following exceptions: two maintenance shutdowns on April 9 and 23; thirteen scheduled shutdowns for flux trap sample changes; and three unscheduled shutdowns whose dates and descriptions follow.

On April 24, the reactor scrammed due to high power Channel 4, as a result of a short circuit across the Channel 4 power supply which occurred when electronic technicians were troubleshooting the regulating blade automatic control circuits. The electronic technicians found a broken solder lead in the regulating blade automatic control circuits, repaired the lead and a short form precritical checkoff was completed, with Channel 4 indicating satisfactory.

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During the ensuing startup, the reactor scrammed at approximately 15" while still subcritical, due to blown master fuse, 2F1, on the reactor console front panel. It is believed that this fuse may have been damaged during the previous unscheduled shutdown, when the 115V power supplied to Channel 4 was shorted. The blown 2F1 fuse was replaced, and clamp-on ammeter readings were taken on all affected circuits, with all readings found to be normal. After performing a short form precritical checkoff, a hot reactor startup was commenced.

The reactor was started up, and at 10 MW, a Channel 4 high power rod run-in was received when attempting to place the reactor in automatic control at 10 MW, when the regulating rod drove out continuously. Reactor power of 10 MW was recovered and the reactor was operated in manual control while the electronic technicians investigated the regulating blade automatic control circuit. The problem in the regulating blade automatic control circuit was found to be a faulty component, and after checking the control system, the reactor was placed in automatic control at 10 MW.

Electronic technicians installed and calibrated a new console mounted digital indication for primary and pool flows, temperatures and DI system flows.

On April 23, the Containment Building Leak Rate Test (RTP-13) was conducted, the leak rate was 10.1 scfm less than the Technical Specification limit of 16.3 scfm.

MAY 1979

The reactor was operated continuously during May, with the following exceptions: two maintenance shutdowns on May 7 and May 21; sixteen

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scheduled shutdowns for flux trap sample changes; and four unscheduled shutdowns whose dates and descriptions follow.

The reactor scrammed due to high power Channel 4 during a reactor hot startup on May 3 when the reactor operator conducting the startup turned the Channel 4 range switch in the wrong direction.

The reactor scrammed due to a momentary dip in electrical power supplied to the facility on May 26. The University Power Plant was called and verified this electrical power transient.

On May 31, a Channel 5 high power rod run-in occurred when the regulating rod failed to respond to an increasing power indication. Reactor power was restored to 10 MW in manual control while the electronic technicians were troubleshooting the regulating rod automatic control circuits. The reason for the regulating rod not responding was traced to a faulty component in the servo amplifier circuit of the automatic control system.

Later the same day, May 31, while the reactor was at 10 MW in manual control with the electronic technicians returning the automatic control system to normal, Channel 4 indication failed down scale. A manual scram immediately initiated by the reactor operator and the electronic technicians found the Channel 4 picoammeter module defective. This module was replaced, the required precritical checkoff was performed and the reactor was returned to 10 MW in automatic control. No further problems have been experienced with the regulating rod automatic control system.

Modification 79-3 was completed by the electronic technicians in May. This modification provides for splitting the electrical loads for nuclear instruments and rod position indications, so that the loss of fuse 2F1 or

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2F5 would not cause the loss of both indications, which are the two most direct indications that verify the reactor shutdown. The instrument panel fans were also removed from the Elgar line conditioner as part of this modification. Additionally, the electronic technicians replaced the molded retainers on all General Electric CR-120A relays with Valox retainers as specified in NRC Bulletin dated March 15, 1979. Control blade 5-3 was aligned on offset number 4 in May and installed in position "C".

Mr. N. E. Durby, N.R.C. Region III inspector, conducted a routine, unannounced inspection of the facility from May 14 to May 17.

JUNE 1979

The reactor was operated continuously during June, with the following exceptions: three maintenance shutdowns on June 4, 18, and 25; thirteen scheduled shutdowns for flux trap sample changes; and two unscheduled shutdowns whose dates and descriptions follow.

On June 29, the reactor was shutdown by manual scram due to failure of the personnel airlock doors. Electronic technicians found the breaker contacts on the outer airlock door highly pitted and corroded. The contacts were cleaned and the doors were placed back in service. During the subsequent startup, with the reactor critical but not yet at 10 MW, the outer airlock door failed again. This time the reactor was shutdown by manual rod run-in and the electronic technicians changed out the breaker for the airlock door, which was found to have an intermittent open in one phase.

Major maintenance items for June consisted of the replacement of cooling tower fan No. 1 hub and blades; the continuation of RTP-16, Nuclepore Test Procedure, and the shipment of eight spent fuel elements to Savannah River Processing Plant.

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Mr. C. H. Brown, N.R.C. Region III Inspector, conducted a routine unannounced inspection of Operating Records and Procedures from June 5 through June 8.

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SECTION II

OPERATING PROCEDURE CHANGES

As required by the MURR Technical Specifications, the Reactor Manager reviewed the Standard Operating and Emergency Procedures during June 1979. Throughout the year, minor changes were made via Standing Orders. These were incorporated into a Standard Operating Procedure revision that is now being reviewed before approval.

The Health Physics Manager conducted his annual review as required by the MURR Technical Specifications.

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SECTION III

REVISIONS TO THE HAZARDS SUMMARY REPORT

Hazard Summary Report Addendum 4 Figure A.10 "Evacuation/Isolation System" was revised. The evacuation switch in room 269 was removed.

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SECTION IV

PLANT AND SYSTEM MODIFICATIONS

August 1978

Modification 78-2: A deflector plate was attached to offset mechanism "A" to prevent a sample holder striking the offset arm. Striking the offset arm will cause a reactor shutdown by dropping the control blade.

Safety Analysis Summary: The deflector plate does not affect the offset method of operation in any way.

Modification 78-6: Due to bonding problems between blade cladding and edge cladding on control blades, the blade thickness was reduced from .200 in. to .175 in. The edge cladding thickness remained at .250 in. which provides more material to weld the edge cladding to the blade.

The minimum weight of Boron-10 per unit area was increased from .0414 to .0418 gm/cm^2 and the neutron attenuation performance was improved due to more effective particle sizes of boron carbide.

Safety Analysis Summary: The new control blade meets the reactivity requirements of Technical Specification, therefore there is no change to the MURR safety analysis. The thicker cladding and better edge cladding weld make the blade less susceptible to blistering.

Modification 76-12: The Regulating Blade Servo Amplifier was replaced with a solid state amplifier to eliminate the old amplifier tubes and to make other circuit improvements.

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Safety Analysis Summary: This unit is designed to be more reliable in auto control of the reactor than the tube amplifier model. The consequences of an auto control failure are the same, i.e. a reactivity insertion of no more than 0.003 ΔK/K which can be safely tolerated.

February 1979

Modification 79-2: The air operated fuel handling tool head was replaced by one identical to the manual fuel tool and air cylinders added to increase buoyancy. These changes resulted in a lower man-rem exposure during refuelings.

Safety Analysis Summary: The modification does not involve an unreviewed safety question as described in 10CFR50.59. The design incorporates designs used in the two MURR fuel handling tools for over ten years.

May 1979

Modification 79-3: The neutron monitoring system and control rod indication were changed from being supplied through a common fuse 2F1 to being supplied by parallel fused power supplies. This eliminated the situation where a single fuse failure would secure power to both primary indications of a reactor shutdown.

Instrument panel fan - power supply was moved from Elgar line conditioner output to reduce conditioned loads.

Safety Analysis Summary: The modification does not involve an unreviewed safety question as described in 10CFR50.59.

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SECTION V

SPECIAL NUCLEAR MATERIAL ACTIVITIES

1. SNM Receipts: During the year, the MURR received fuel from Rockwell Int'l. Energy Systems Group (Atomics International). A total of 18 elements were received. A natural UO_2 sphere was received from Battelle, 4/30/79, for use in the Engineering Department.

Date	Shipper	Elements	Grams U	Grams U-235	Remarks
11/30/78	Atomics Int'l.	M01, M02	1,660.93	1,546.95	(a)
12/15/78	Atomics Int'l.	M03, M04, M05, M06	3,322.03	3,094.16	(a)
1/26/79	Atomics Int'l.	M07, M08, M09, M010	3,322.47	3,094.52	(a)
4/18/79	Atomics Int'l.	M011, M012, M013, M014	3,322.73	3,094.74	(a)
6/22/79	Atomics Int'l.	M015, M016, M017, M018	3,321.33	3,093.45	(a)

(a) Receipt of new fuel elements.

2. SNM Shipments: One shipment of three fuel elements (350 gms each) to Atomics International for temporary storage. One shipment of eight spent fuel elements was sent to U.S.D.O.E. Savannah River Plant.

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Date	Shipper	Elements	Grams U	Grams U-235	Remarks
5/07/79	MURR	350F1, 350F3 350F4	1,112.39	1,036.19	(b)
6/25/79	MURR	775F49, 775F51, 775F67, 775F68, 775F72, 775F80, 775F81, 775F83	5,414.56	4,725.53	(c)

(b) Temporary storage.

(c) Spent fuel for reprocessing.

3. Inspections: On January 22-24, 1979, a Physical Protection Inspection was conducted by Mr. J. L. Belanger and Ms. G. M. Christoffer of Region III, USNRC. No items of noncompliance were identified during the course of their inspection.

On February 21-23, 1979, a Special Nuclear Material Control and Accountability Inspection was conducted by Messrs. A. G. Finley and J. P. Patterson of Region III, USNRC. No items of noncompliance was identified as a result of this inspection.

4. SNM Inventory: As of 30 June 1979, the MURR financially responsible inventory was as follows:

Total U = 44,460.78 grams

Total U-235 = 39,497.27 grams

All of this material is physically located at the MURR. In addition, MURR has three 350 gram elements stored at Atomics International.

Total U = 1,112.39 grams

Total U-235 = 1,036.19 grams

Also MURR owns a total of 116 grams U and 37 grams U-235.

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Fuel elements on hand have accumulated the following burnup as of 30 June 1979:

Fuel Element Number	Accumulated MWD	Fuel Element Number	Accumulated MWD
350F2	4.92	M01	107.14
775F55	146.89	M02	107.14
775F60	147.36	M03	75.38
775F62	146.26	M04	75.96
775F64	146.49	M05	75.38
775F65	146.71	M06	75.96
775F70	144.95	M07	69.80
775F71	144.95	M08	54.68
775F73	147.92	M09	65.33
775F74	141.99	M010	54.68
775F75	146.40	M011	29.34
775F76	146.40	M012	29.03
775F77	146.89	M013	34.22
775F78	141.98	M014	23.99
775F79	139.06	M015	0
775F82	148.12	M016	0
775F84	148.12	M017	0
775F85	149.24	M018	0
775F86	139.42		
775F87	145.42		
775F88	146.12		
775F89	129.41		
775F90	144.01		
775F91	146.55		
775F92	147.80		
775F93	129.41		
775F94	144.01		
775F95	148.54		
775F96	148.38		
775F97	148.95		
775F98	120.50		
775F99	148.12		
775F100	143.98		
775F101	148.85		
775F102	142.87		
775F103	142.87		
775F104	143.98		
775F105	139.62		
775F106	139.62		
775F107	123.78		
775F108	123.78		
775F109	123.46		
775F110	112.08		
775F111	112.18		
775F112	108.03		

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SECTION VI

REACTOR PHYSICS ACTIVITIES

1. Fuel Utilization: During this period, the following elements reached their licensed burnup and were retired.

775F73	775F88	775F97
775F77	775F90	775F99
775F81	775F91	775F100
775F82	775F92	775F101
775F83	775F94	775F102
775F84	775F95	775F103
775F85	775F96	775F104

There was one initial critical experiment conducted during the past fiscal year for a core of eight new elements.

Core XX was initially tested on 3 July 1978. Due to requirements of having less than 5 kg of unirrediated fuel on hand at any one time, initial criticalities are now conducted with six new elements or less as conditions dicticate.

Core XXI	M01, 2	4 December 1978
	M03, 4, 5, 6	8 January 1979
	M07	9 March 1979
	M0 9	19 March 1979
Core XXII	M08, 10	26 March 1979
	M011, 13	3 May 1979
	M012	7 May 1979
	M014	4 June 1979
	M015, 16	(12 July 1979) Fiscal Year 1980

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2. Fuel Shipping: One spent fuel shipment of 8 elements departed the facility on 25 June 1979. The shipment contained the following elements.

775F49	775F72
775F51	775F80
775F67	775F81
775F68	775F83

3. Fuel Procurement: At the present time, MURR fuel is being fabricated by Rockwell Int'l. Energy Systems Group of Canoga Park, California. This work is contracted with USDOE and administered by the Idaho Operations Office. Future plans include building up a 2-year inventory of fuel or greater with possible storage in Idaho.

4. Licensing Activities: The proposal submitted last year to increase the allowable Facility Gaseous and Particulate Release to levels allowed by 10 CFR is still pending. A license was granted for using G.E. Model 700 Shipping Cask for MURR spent fuel shipments. Amendment No. 9 was issued 23 March 1978 changing the inspection time interval for control blades such that every control blade is inspected every two years. Amendment No. 10 was issued 13 July 1978 allowing MURR containment building leak test to be performed at 1 psig using the makeup flow technique. Amendment No. 11 was issued 26 January 1979 incorporating a revision to the University of Missouri Research Reactor (MURR) security plan.

5. Continuing Studies:

   a. Increased loading of fuel elements.

   b. Quality Assurance Programs for Shipping Casks.

   c. Licensing National Lead Shipping Cask.

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SECTION VII

SUMMARY OF RADIOACTIVE EFFLUENTS RELEASED TO THE ENVIRONMENT

Liquid Effluent - 7-1-78 to 6-30-79*

Nuclide	Amount (Ci)
H-3 via cooling tower drain	0.00167
H-3	0.124131
Na-24	0.000788
Sc-46	0.000908
Cr-51	0.001831
Mn-54	0.001174
Co-58	0.000319
Co-60	0.002583
Cu-64	0.000041
Zn-65	0.003303
Tc-99m	0.000020
In-113m	0.000694
Sn-113	0.000350
Sb-124	0.007468

*Except as noted material was released directly to sanitary sewer via waste tank system.

Stack Effluent - 7-1-78 to 6-30-79

Nuclide		Amount (Ci)
H-3		3.8*
Na-24		.000009
Cl-38		.000321
Ar-41		2122.1
Cr-51		.000003
Mn-54	<	.000001
Mn-56		.000005
Co-57	<	.000001
Co-60		.000007
Cu-64		.000002
As-77		.000004
Br-82		.000151

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Stack Effluent - 7-1-78 to 6-30-79

Nuclide	Amount (Ci)
Sr-85	.000001
Kr-85m	.000001
Kr-87	.000001
Kr-88	.000001
Y-92	.000147
Nb-95	.000001
Rh-106	.000023
Sn-113	.000001
In-113m	.000001
In-114m	.000001
Cd-115	.000063
I-128	.000026
I-130	.000003
I-131	.000788
Xe-131m	.000024
Te-132	.000047
I-132	.000265
Xe-133	.000031
I-133	.001550
I-134	.000846
Xe-135	.000048
Xe-135m	.000088
I-135	.001291
Cs-138	.000008
Ba-139	.000022
Ba-140	< .000001
La-140	< .000001
Ce-144	.000054
Hz-181	< .000001
Au-198	< .000001
Hg-203	.000003
Bi-214	.000001
Pb-214	< .000001
Ra-226	.000002

*0.30299 Ci H-3 evaporated to atmosphere via cooling tower in addition to H-3 release via exhaust stack.

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SECTION VIII

SUMMARY OF ENVIRONMENTAL SURVEYS

Environmental samples are collected twice yearly at nine locations and analyzed for radioactivity. These locations are shown in Figure 1. Soil and vegetation samples are taken at each location. Water samples are taken at four of the nine locations. The results are given in tne following tables.

Detection Limits

Matrix	Alpha	Beta	Gamma	Tritium
Water	0.2 pCi/l	2.5 pCi/l	0.04 pCi/l	9.1 pCi/ml
Soil and vegetation	0.2 pCi/g	2.5 pCi/g	0.04 pCi/g	9.1 pCi/g

1. Sampling Date: 10/18/78

Determined Activity Concentration

Sample	Alpha	Beta	Gamma	Tritium
1 V 14	<0.2 pCi/g	47.4 pCi/g	<0.04 pCi/g	<9.1 pCi/g
2 V 14	0.6 pCi/g	33.8 pCi/g	<0.04 pCi/g	<9.1 pCi/g
3 V 14	0.7 pCi/g	31.6 pCi/g	<0.04 pCi/g	<9.1 pCi/g
4 V 14	0.5 pCi/g	33.5 pCi/g	<0.04 pCi/g	<9.1 pCi/g
5 V 14	0.2 pCi/g	31.3 pCi/g	<0.04 pCi/g	<9.1 pCi/g
6 V 14	<0.2 pCi/g	42.1 pCi/g	<0.04 pCi/g	<9.1 pCi/g
7 V 14	0.3 pCi/g	38.5 pCi/g	<0.04 pCi/g	<9.1 pCi/g
8 V 14	0.5 pCi/g	27.9 pCi/g	<0.04 pCi/g	<9.1 pCi/g
9 V 14	<0.2 pCi/g	38.3 pCi/g	<0.04 pCi/g	<9.1 pCi/g

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Determined Activity Concentration - continued

Sample	Alpha	Beta	Gamma	Tritium
1 S 14	0.7 pCi/g	5.5 pCi/g	<0.04 pCi/g	<9.1 pCi/g
2 S 14	0.9 pCi/g	5.5 pCi/g	<0.04 pCi/g	<9.1 pCi/g
3 S 14	0.8 pCi/g	5.3 pCi/g	<0.04 pCi/g	<9.1 pCi/g
4 S 14	0.5 pCi/g	3.2 pCi/g	<0.04 pCi/g	<9.1 pCi/g
5 S 14	1.1 pCi/g	1.9 pCi/g	<0.04 pCi/g	<9.1 pCi/g
6 S 14	0.7 pCi/g	3.2 pCi/g	<0.04 pCi/g	<9.1 pCi/g
7 S 14	0.7 pCi/g	5.0 pCi/g	<0.04 pCi/g	<9.1 pCi/g
8 S 14	3.2 pCi/g	9.7 pCi/g	<0.04 pCi/g	<9.1 pCi/g
9 S 14	0.4 pCi/g	41.2 pCi/g	<0.04 pCi/g	<9.1 pCi/g
4 W 14	0.6 pCi/l	6.7 pCi/l	<0.04 pCi/l	<9.1 pCi/ml
6 W 14	<0.2 pCi/l	5.3 pCi/l	<0.04 pCi/l	<9.1 pCi/ml
8 W 14	1.2 pCi/l	28.5 pCi/l	*1.03×10^3 pCi/l	<9.1 pCi/ml
9 W 14	3.4 pCi/l	96.7 pCi/l	*3.04×10^3 pCi/l	<9.1 pCi/ml

*Gamma photo peak was observed and identified as I-131. Verification letter from Health Physics Services relative to release of I-131 to sanitary sewer from University Medical Center, 10/16/78 through 10/18/78, in file.

Detection Limits

Matrix	Alpha	Beta	Gamma	Tritium
Water	0.2 pCi/l	2.5 pCi/l	0.04 pCi/l	9.1 pCi/ml
Soil and vegetation	0.2 pCi/g	2.5 pCi/g	0.04 pCi/g	9.1 pCi/g

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2. Sampling Date: 4/30/79

Determined Activity Concentration

Sample	Alpha	Beta	Gamma	Tritium
1 V 15	<0.2 pCi/g	30.0 pCi/g	<0.04 pCi/g	<9.1 pCi/g
2 V 15	<0.2 pCi/g	23.7 pCi/g	<0.04 pCi/g	<9.1 pCi/g
3 V 15	<0.2 pCi/g	22.8 pCi/g	<0.04 pCi/g	<9.1 pCi/g
4 V 15	<0.2 pCi/g	25.9 pCi/g	<0.04 pCi/g	<9.1 pCi/g
5 V 15	<0.2 pCi/g	25.3 pCi/g	<0.04 pCi/g	<9.1 pCi/g
6 V 15	<0.2 pCi/g	32.4 pCi/g	<0.04 pCi/g	<9.1 pCi/g
7 V 15	<0.2 pCi/g	27.9 pCi/g	<0.04 pCi/g	<9.1 pCi/g
8 V 15	<0.2 pCi/g	18.0 pCi/g	<0.04 pCi/g	<9.1 pCi/g
9 V 15	<0.2 pCi/g	22.2 pCi/g	<0.04 pCi/g	<9.1 pCi/g
1 S 15	0.6 pCi/g	15.7 pCi/g	<0.04 pCi/g	
2 S 15	0.6 pCi/g	14.8 pCi/g	<0.04 pCi/g	
3 S 15	1.0 pCi/g	13.7 pCi/g	<0.04 pCi/g	
4 S 15	0.8 pCi/g	10.6 pCi/g	<0.04 pCi/g	
5 S 15	0.5 pCi/g	7.1 pCi/g	<0.04 pCi/g	
6 S 15	0.2 pCi/g	10.7 pCi/g	<0.04 pCi/g	
7 S 15	0.6 pCi/g	10.2 pCi/g	<0.04 pCi/g	
8 S 15	0.3 pCi/g	12.9 pCi/g	<0.04 pCi/g	
9 S 15	0.2 pCi/g	11.6 pCi/g	<0.04 pCi/g	
4 W 15	<0.2 pCi/g	2.7 pCi/l	<0.04 pCi/l	<9.1 pCi/ml
6 W 15	<0.2 pCi/g	3.7 pCi/l	<0.04 pCi/l	<9.1 pCi/ml
8 W 15	0.4 pCi/g	4.1 pCi/l	<0.04 pCi/l	<9.1 pCi/ml
9 W 15	<0.2 pCi/g	1.4 pCi/l	<0.04 pCi/l	<9.1 pCi/ml

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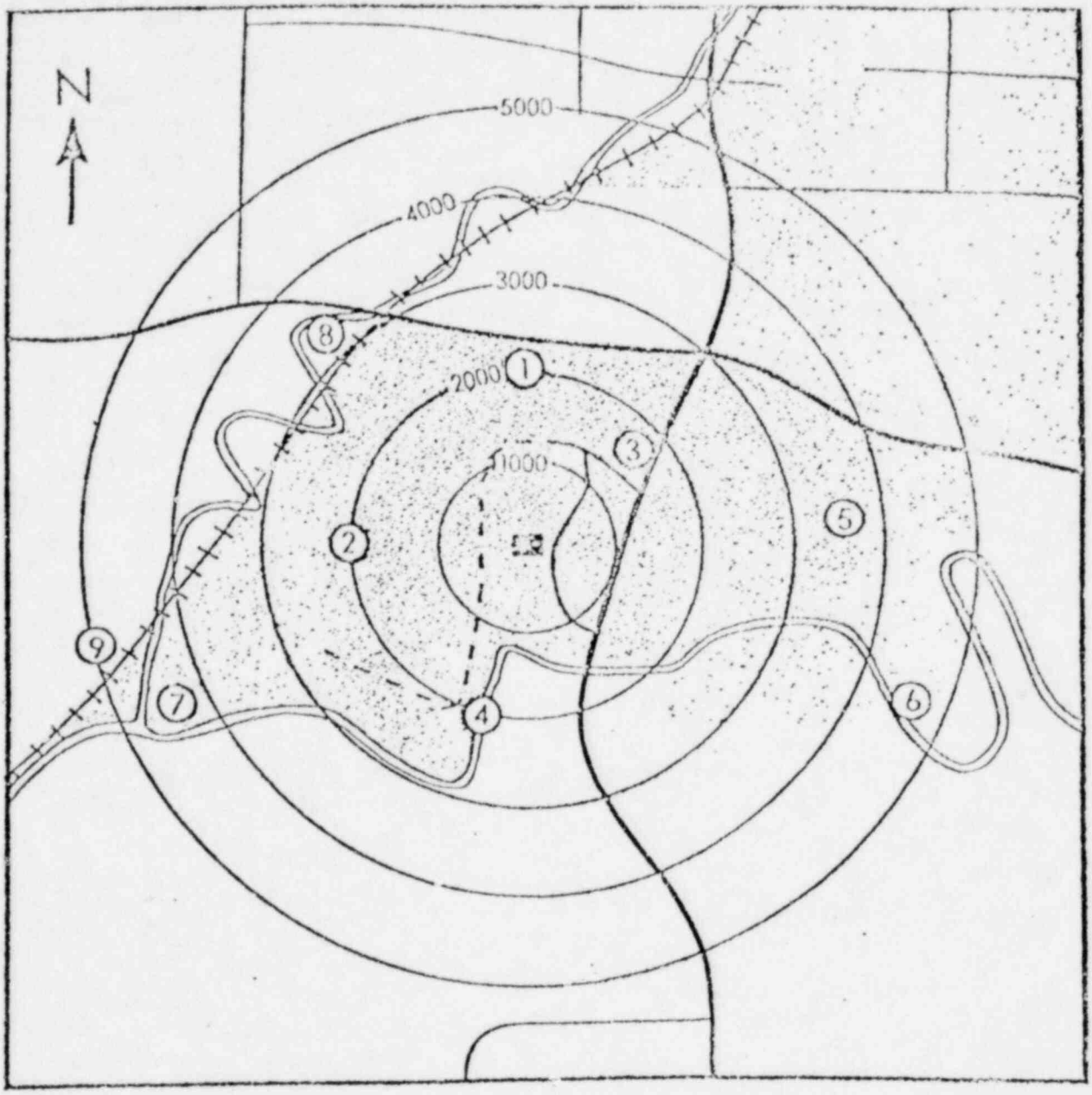
POOR
ORIGINAL



LOCATION OF SAMPLE STATIONS
RESEARCH REACTOR FACILITY
UNIVERSITY OF MISSOURI

Figure 1

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SUMMARY OF RADIATION EXPOSURES TO FACILITY STAFF, EXPERIMENTERS AND VISITORS

Personnel Monitoring (exposure in mrem)

1978

	July				August				September				October				November				December			
A	B	C	D	E	B	C	D	E	B	C	D	E	B	C	D	E	B	C	D	E	B	C	D	E
G	46	6	42	110	49	1	20	20	42	1	80	80	42	1	43	43	42	3	23	30	35	2	15	20
U(G)	13	7	309	920	12	6	192	490	15	5	160	290	14	4	310	760	15	6	135	350	10	5	76	110
G-Spare+	10	1	20	20	14	1	40	40	5	1	50	50	14	1	20	20	4	0	NA	NA	14	1	20	20
U(G)Spare+	4	2	40	50	2	3	100	130	0	4	375	1230	3	2	175	320	NA	NA	NA	NA	0	2	120	130
H	59	49	89	340	57	43	117	330	59	42	113	340	65	36	139	570	56	39	96	430	54	42	112	280
U(H)	10	22	284	1030	5	24	467	2470	2	26	262	790	4	27	166	750	7	23	240	960	6	24	213	810
H-Spare+	8	1	10	10	7	1	50	50	12	1	20	20	5	3	90	130	6	0	NA	NA	6	2	225	370
U(H)-Spare+	1	1	40	40	1	1	220	200	0	3	260	530	2	0	NA	NA	0	2	80	120	0	1	240	240
D	2	59	87	448	5	54	78	467	9	49	47	160	4	51	80	282	3	56	77	230	5	54	69	235
GVIS*	1	1	10	10	1	1	70	70	0	0	NA	NA	0	0	NA	NA	0	0	NA	NA	1	1	30	30

1979

	January				February				March				April				May				June			
G	45	2	55	80	47	1	40	40	47	1	20	20	52	2	25	30	51	1	20	20	48	0	NA	NA
U(G)	11	4	210	470	15	3	283	720	11	4	62	80	15	5	314	800	12	6	243	950	14	3	400	1110
G-Spare+	8	0	NA	NA	4	0	NA	NA	2	0	NA	NA	16	0	NA	NA	5	4	35	50	15	1	30	30
U(G)Spare+	2	2	60	90	2	0	NA	NA	3	0	NA	NA	0	0	NA	NA	0	1	130	130	1	1	40	40
H	65	28	74	130	51	46	130	620	39	55	71	340	70	25	59	160	59	38	125	420	67	32	85	260
U(H)	9	21	136	490	3	29	310	1310	7	27	160	600	7	28	148	560	8	28	419	2280	12	25	186	560
H-Spare+	9	0	NA	NA	7	1	60	60	1	4	60	70	3	0	NA	NA	11	2	60	70	7	5	60	90
U(H)-Spare+	0	0	NA	NA	0	2	130	210	0	2	90	110	0	1	40	40	0	0	NA	NA	0	0	NA	NA
D	54	5	77	415	4	56	53	225	1	49	66	230	4	48	48	180	3	53	86	320	2	53	63	245
GVIS*	0	0	NA	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA	NA	2	2	60	60	0	0	NA	NA

Note:
G = monthly beta-gamma film badge
U(G) = monthly finger TLD
H = biweekly beta-gamma-neutron film badge
U(H) = biweekly finger TLD
D = self-reader dosimeters
GVIS = G badge worn by visitor

*Measurable Exposures Recorded Only
+Used for temporary workers, new workers prior to issue of permanent, and replacement for lost badges

Column Headings
A. Type of dosimeter
B. Number reported as minimum
C. Number reported with exposures above minimum
D. Average of exposures above minimum
E. Single highest dosimeter reported

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Radiation and Contamination Surveys

The following table gives the number of surveys performed during Fy 78-79.

Radiation	Contamination
272	193

Sixteen (16) Radiation Work Permits were issued during the year.

Miscellaneous Items

Reactor Health Physics has added a full-time technician position and a half-time technician trainee position.

Approximately $20,000 in new monitoring equipment has been added to the Reactor Health Physics inventory.

The facility effluent stack monitor was moved to a location more accessible for observation and service. The new location also has a more stable radiation background. An isokinetic sample probe was designed and installed in the effluent plenum to assure more accurate sampling of airborn particulates.

Formal surveys of laboratories were changed from monthly to quarterly because actual monitoring in laboratories increased due to the increase in work involving Health Physics on a daily basis. Daily swipe surveys of the facility floors continue to indicate good control of radioactive materials.

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