**Oak Ridge Research Reactor Quarterly Report
January, February, and March of 1977**

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MASTER

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION FOR THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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OAK RIDGE RESEARCH REACTOR QUARTERLY REPORT

JANUARY, FEBRUARY, AND MARCH OF 1977

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SUMMARY

The ORR operated at an average power level of 29.2 Mw for 23.6% of the time during January, February, and March of 1977. Six fuel elements were declared spent (56.3% burnup) during the quarter, while five new elements were placed in service.

The reactor was shut down on seven occasions, none of which were unscheduled. Reactor downtime needed for refueling, maintenance and checks was quite low, with the reactor remaining available for operation 87.0% of the time.

Maintenance activities, both mechanical and instrument were essentially routine in nature.

OPERATIONS

The basic operating data presented in Table 1 indicates that the ORR operation for the quarter was normal as compared with recent experience.

Details relative to cycles of operation during the quarter are given in Table 2.

Table 1. ORR Basic Operating Data
Period: January, February, and March of 1977

	This Quarter	Last Quarter	Year To Date	January Through March, 1976
Total energy, Mwd	620.4	554.3	620.4	2,254.4
Average power, Mw/operating hr	29.2	29.3	29.2	29.9
Time operating, %	23.6*	20.5*	23.6*	82.8
Availability, %	87	92	87	90.6
Reactor water radio- activity, $\frac{\text{c/min}}{\text{ml}}$ (av)	26,300	25,400	26,300	28,200
Pool water radio- activity, $\frac{\text{c/min}}{\text{ml}}$ (av)	690	570	690	610
Reactor water resis- tivity, ohm-cm (av)	2,038,000	1,676,000	2,038,000	822,000
Pool water resis- tivity, ohm-cm (av)	1,730,000	1,325,000	1,730,000	799,000
Fuel elements depleted	5	6	5	2
Average burnup of fuel elements depleted, %	56.3	57.6	56.3	58.8
Shim rods depleted	0	0	0	4
Average burnup of shim rods depleted, %	0	0	0	64.4
Radioisotope samples	1	0	1	0
Research samples	1	1	2	1

*Time operating (%) low due to reduced level of funding.

Table 2. Cycles of Operation

Cycle No.	Date Begun	Date Ended	Accumulated Energy (Mwd)
136	January 16, 1977	February 18, 1977	316.6
137	March 13, 1977	In Progress	303.7

FUEL USAGE AND INVENTORY

Six fuel elements were spent during the quarter with an average burnup of 56.3 percent. Five new fuel elements were placed in service.

Other details of fuel usage and inventory may be found in Tables 1 and 3.

Table 3. ORR Fuel Status

	This Quarter	Last Quarter	Jan.-March 1977	Jan.-March 1976
Depleted fuel elements transferred for chemical separation	0	13	0	45
Average percent burnup of fuel element transferred	---	55.2	---	52.0
New fuel elements placed in service	5	0	5	28
New fuel elements available for use	58*	63		
Depleted shim rods transferred for chemical separation	0	4	---	6
Average percent burnup of shim rods transferred	---	64.4	---	65.0
New shim rods placed in service	0	0	0	4
New shim rods available for use	2	2		0

* Includes 4 partial fuel elements.

SHUTDOWNS AND POWER REDUCTIONS

Reactor downtime (power level $<N_L$) totaled approximately 1,650 hours. A summary of the shutdowns is given in Table 4, and details of each are contained in Table 5. Table 6 offers information relative to power reductions which did not result in a shutdown.

Table 4. Summary of Shutdowns

Description of Shutdown	Number	Downtime (hr)
Scheduled		
Regular, end of cycle. Iodine removal and maintenance.	2	816.250
Regular, experiment work.	1	186.517
Regular, refueling and iodine removal.	1	538.267
Special, completion of a run for a new ^{16}N instrument channel check.	1	91.783
Regular, refueling and experiment work.	1	9.167
Special, completed a startup for checking proper operation of reactor instrumentation.	1	8.500
Subtotal	7	1,650.484
Unscheduled		
	0	0
Subtotal	0	0
Total	7	1,650.484

Table 5. ORR Scheduled Shutdowns, Details

Date	Duration (hr)	End Cycle	Remarks
1-1-77	372.583	135	The shutdown, which began 12-31-76, marked the end of operating cycle 135. Shutdown activities included: (1) iodine-xenon work, (2) routine end-of-cycle checks, and (3) programmed maintenance.
1-21-77	538.267	136A	The shutdown activities included refueling and iodine-xenon work.
2-18-77	816.250	136B	The shutdown marked the end of operating cycle 136. Shutdown activities included: (1) iodine-xenon work, (2) an audio inspection of the reactor primary water decay tank, (3) the replacement and relocation of ^{16}N picoammeters with new ^{16}N picoammeters, (4) the repairs of a crack on the bell housing on the south fan motor at the reactor secondary cooling tower, (5) the general repairs of the Nos. 1 and 2 ΔT recorders, (6) the repairs of the fan cylinder on the pool cooling tower, and (7) the replacement of the Lucite viewing ports and gaskets on the reactor tank access cover.
3-9-77	91.783	137A	The shutdown ended a short power run for checking the operation of the replacement ^{16}N instrumentation.
3-18-77	9.167	137B	The reactor was refueled and iodine-xenon work was completed. Experiment work consisted of removal of a nose cone experiment can from P-5, P-6 facility and after completing a change of position in one of the remaining experiment cans, the nose cone experiment was reinstalled in the poolside facility P-5, P-6.
3-23-77	186.517	----	This shutdown marked the end of the nose cone experiment run. The experiment was removed from the poolside facility P-5, P-6.
3-31-77	8.500	----	This shutdown ended a short power run for checking the reactor control instrumentation. The reactor shutdown will be carried over to the following month, which will be recorded in the next quarterly report.

Table 6. Reductions in ORR Power Not Resulting in Shutdowns

Date	Source of Signal	Type of Signal	Lowest Power (Mw)	Comments
1-18-77	Setback	Automatic	28.5	The setback was momentary and came as a result of reversing reactor secondary tower fan causing the primary by-pass valve to close which resulted in the primary flow decreasing to the 17,000 GPM setback point.
1-21-77	Setback	Automatic	15.5	The reactor primary water temperature controller was switched from manual control to automatic control thus causing the primary by-pass valve to close and this resulted in a decrease of the primary flow to the 17,000 GPM setback point.
2-14-77	Reverse	Automatic	21.0	The I&C technician accidentally touched the slide wire on the No. 1 safety recorder after the recorder was turned on following routine maintenance.
2-16-77	Setback	Automatic	28.0	An adjustment was being made on the No. 2 sigma amplifier sensitivity to obtain a readout of 100%. The readout on the No. 2 safety recorder spiked to 110% which initiated the setback due to a fault in the sensitivity switch.

INSTRUMENTATION AND REACTOR CONTROLS

The performance of the instrumentation for the complex was quite satisfactory and only rather routine maintenance was required as indicated in Table 7.

PROCESS SYSTEM AND MECHANICAL COMPONENTS

Details of maintenance or changes to the process system are given in Table 8. Table 9 summarizes the results of efficiency tests of the various gaseous waste filters.

EXPERIMENT FACILITIES AND CORE CHANGES

Experiment facility usage is given in Table 10. The core configuration used during the quarter is shown in Figure No. 1.

ORR LATTICE LOADING

For Fuel Cycles 136A, 136B, 137A, & 137B

	1	2	3	4	5	6	7	8	9
A	Be	Be	Be	F	F	F	Be	Be	Be
B	Be	Be	F	SR	F	SR	F	Be	Be
C	Be	Be	F	F	F	F	F	F	Be
D	Be	Be	F	SR	F	SR	F	HT	Be
E	Be	Be	F	F	F	F	¹³¹ I	F	Be
F	Be	Be	F	SR	F	SR	F	SR	Be
G	Be	Be	Be	Be	Be	Be	Be	Be	Be

<u>LATTICE COMPONENT</u>	<u>NUMBER</u>
Fuel	<u>24</u>
Shim Rod (SR)	<u>6</u>
Beryllium (Be)	<u>31</u>
Experiment (E)	<u>0</u>
Iodine Sleeve (¹³¹ I)	<u>1</u>
Isotope Stringer (Iso)	<u>0</u>
Hydraulic Tube (HT)	<u>1</u>

Figure 1. ORR Lattice Configuration - January 1, 1977,
Through March 31, 1977

Table 7. Maintenance and Changes, Instrumentation and Controls

Date	Component	Trouble or Change	Reason or Maintenance
No. 1 Safety Channel			
3-22-77	Safety ionization chamber	Saturation characteristic checks	The saturation characteristics were within specifications.
No. 2 Safety Channel			
2-22-77	Sigma amplifier	Sensitivity switch	The sensitivity switch contacts were repaired.
3-22-77	Safety ionization chamber	Saturation characteristic checks	The saturation characteristics were within specifications.
No. 3 Safety Channel			
3-22-77	Safety ionization chamber	Saturation characteristic checks	The saturation characteristics were within specifications.
Magnet Amplifiers			
No maintenance or changes were required.			
No. 1 Gamma Channel			
3-22-77	Gamma ionization chamber	Saturation characteristic checks	The saturation characteristics were within specifications
No. 2 Gamma Channel			
2-16-77	Gamma recorder amplifier	Replacement	The faulty amplifier was replaced.

Table 7. (Continued)

Date	Component	Trouble or Change	Reason or Maintenance
No. 1 Counting-Rate Channel			
1-21-77	No. 1 fission chamber drive assembly	Replacement	The drive assembly was replaced.
No. 2 Counting-Rate Channel			
1-28-77	Count-rate meter amplifier	Replacement	The amplifier was replaced to correct an erratic readout
No. 1 Log-N Channel			
3-22-77	Log-N ionization chamber	Saturation characteristic checks	The saturation characteristics were within specifications.
No. 2 Log-N Channel			
3-22-77	Log-N ionization chamber	Saturation characteristic checks	The saturation characteristics were within specifications.
2-14-77	Safety recorder slide-wire	Erratic readout	The slide-wire was cleaned.
No. 2 Gamma Channel			
3-22-77	Gamma ionization chamber	Saturation characteristic checks	The saturation characteristics were within specifications.

Table 7. (Continued)

Date	Component	Trouble or Change	Reason or Maintenance
North ¹⁶ N and South ¹⁶ N Channels			
2-22-77	¹⁶ N picoammeters	Replacement and relocation	Replaced the vacuum tube picoammeters with Solid State versions (Reactor Instrument and Controls Design Change Memo ORR-113).
Micromicroammeter Channel			
No maintenance or changes were required.			
Process Instrumentation			
2-23-77	Nos. 1 and 2 ΔT recorders	General repairs	New balance motors and slide wire were installed. The recorders were calibrated.
1-19-77	Reactor water activity module	Erratic readout	The module was calibrated.
2-16-77	Cell ventilation filter temperature recorder	Erratic readout	The amplifier was retubed to correct the problem.
3-15-77	Primary pump bearing temper- ature recorder	Erratic readout	The recorder was repaired

Table 7. (Continued)

Date	Component	Trouble or Change	Reason or Maintenance
Process Instrumentation			
3-15-77	Control room multi-point temperature recorder	Erratic readout	The constant voltage unit was replaced.
3-7-77 through 3-11-77	Control room recorders	Routine maintenance	All of the control room recorders were cleaned and routine maintenance was performed.

Table 8. Process Systems, Maintenance and Changes

Date	Component	Remarks
Reactor Primary Cooling System		
1-10-77	Primary water pumps	The current on each pump was checked as part of the programmed maintenance.
2-14-77	Primary decay tank	An audio inspection was performed. There was no change since the last inspection.
Reactor Secondary Cooling System		
1-10-77	Cooling tower (water pumps)	The current on each pump was checked as part of the programmed maintenance.
Pool Secondary Cooling System		
3-1-77	Cooling tower fan cylinder	The fan cylinder was repaired, cleaned, and painted.
Emergency Cooling System		
1-14-77	Nos. 1, 2, and 3 dc units	The brushes were inspected as part of the programmed maintenance. All brushes were okay.
3-3-77	Nos. 1, 2, and 3 dc units	Functional tests of equipment and alarms were completed with satisfactory results.
Electrical System		
2-23-77 and 2-24-77	New ¹⁶ N picoammeter	Electrical cables were installed for the new location in the control room-amplifier cabinet "A".

Table 8. (Continued)

Date	Component	Remarks
Emergency Electrical System		
3-1-77	Diesel generator	The routine end-of-cycle load test was performed with satisfactory results.
Normal Off-Gas System		
1-26-77 and 1-27-77	East filter bank	New Hepa and charcoal filters were installed.
Miscellaneous		
1-27-77 and 3-8-77	Spare No. 3 hold-down arm	New bearings were installed.
2-23-77 and 2-24-77	Building (ORR) overhead crane	New brake shoes and linings were installed.
2-28-77	Building (ORR) overhead crane	The crane was load tested. Results were satisfactory.
3-31-77	Building air conditioning	Maintenance as follows: (1) the purge unit was overhauled, (2) the system was leak checked, (3) compressor oil was replaced, (4) Freon was added, and (5) performed scheduled programmed maintenance.

Table 9. Status of Filters - Gaseous Waste System

Type Filter	Bank Designation	Date Installed	Date Last Tested	Type Test	Retention Efficiency (%)
Cell Ventilation System					
CWS	Overall [*]	North, 6-20-73 South, 1-12-65	3-25-77	DOP	99.996
Charcoal	Both banks	North, 9-16-74 South, 10-17-67	3-1-77	Elemental Iodine	99.900
Charcoal	Both banks	North, 9-16-74 South, 10-17-67	3-3-77	Methyl Iodide	26.100
Pressurizable Off-Gas					
CWS	North	5-5-75	3-25-77	DOP	99.894
Charcoal	North	2-25-73	1-28-76	Elemental Iodine	99.940
Charcoal	North	2-25-73	10-7-75	Methyl Iodide	87.970
CWS	South	10-18-67	3-25-77	DOP	99.998
Charcoal	South	8-11-75	8-13-75	Elemental Iodine	99.993
Charcoal	South	8-11-75	10-8-75	Methyl Iodide	97.480

^{*}The CWS filters in the cell ventilation system were checked in series.

Table 9. (Continued)

Type Filter	Bank Designation	Date Installed	Date Last Tested	Type Test	Retention Efficiency (%)
Basement Hood Exhaust					
CWS	South	10-4-76	10-4-76	DOP	99.997
CWS	North	10-4-76	10-4-76	DOP	99.998
Normal Off-Gas					
CWS	West	2-12-76	9-30-76	DOP	99.998
Charcoal	West	2-12-76	8-3-76	Elemental Iodine	99.940
CWS	East	1-26-77	3-25-77	DOP	99.997
Charcoal	East	1-26-77	1-26-77	Elemental Iodine	99.960
Charcoal	West	2-12-76	4-20-76	Methyl Iodide	99.930
Charcoal	East	1-26-77	4-20-76	Methyl Iodide	94.140

Table 10. Experiment Facility Usage

Facility	Access Flange	Date Installed	Date Removed	Description of Experiment	Division or Other Sponsor
D-8	V-3	3-10-67		Hydraulic tube No. 2 used for isotope production and short term irradiations	Operations
E-7	V-5	8-4-76		Radioisotopes (iodine & xenon)	Operations
P-5, P-6	None	3-11-77	3-23-77	Graphite nose cones	General Electric
HB-3	None	11-1-58		Neutron diffraction experiments	Solid States Physics
HB-6	None				Solid States
HB-3	None	11-59		Activation analysis	Analytical Chemistry
HN-4	None	12-15-63		Void determinations in irradiated materials	Solid States Physics
HN-4	None	12-15-63		"Fly's Eye" two-dimensional neutron detector for neutron diffraction and radiography	Instrumentation and Controls

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