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PRELIMINARY PROGRAM PLANNING DETAILS FOR THE PLUM BROOK REACTOR FACILITY, CY 1964

MASTER

Astronuclear Laboratory
Westinghouse Electric Corporation

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I. PROJECTED RUN SCHEDULE

It is planned that the Plum Brook Reactor will operate on a ten-day cycle, that is, ten days of operation followed by eleven days of shutdown. Figure 1 indicates this schedule for CY '64 on a calendar basis. WANL is planning to use the HT-1 (horizontal through hole No. 1) of the PBRF on a continuing basis. The WANL test items, length of irradiation and other pertinent information are included in this report.

Figure 1. Schedule of Plum Brook Reactor Operation Cycles (Revised 11/15/63)

II. TESTS TO BE CONDUCTED AND IRRADIATION TIMES

<u>Date</u>	<u>Cycle No.</u>	<u>WANL Test No.</u>	<u>Test Item</u>	<u>Irradiation Times</u>	<u>Capsule Conditions</u>
10/12-10/22	6	40/W004 23/W202	Control Drum Bearing Linear Displacement Transducers	2.2 hr 50 hr	W-2 W-2
11/2-11/12	7	No Tests Scheduled			
11/23-12/3	8	23/W505	Pressure Transducers	50 hr	W-2
12/14-12/24	9	23/W003 23/W406	Accelerometers (Static) Strain Gauges	50 hr 50 hr	W-2 W-2
1/4 - 1/14	10	23/W106 23/W303 23/W006	Resistance Thermometers } Thermocouples Accelerometers (Dynamic)	50 hr 50 hr	W-2 W-2
1/25- 2/4	11	No Tests Scheduled - Installation of W-2-1 Loop			
2/15-2/25	12	23/W205 23/W506	Linear Displacement Transducers Pressure Transducers	50 hr 50 hr	W-2-1 W-2-1
3/7 - 3/17	13	26/W003 23/W408 40/W006 39/W101	Harnesses, Cables and Connectors Strain Gauges Control Drum Bearing Fuel Material (F.P.)	50 hr 50 hr 2.2 hr 1 hr	W-2-1 W-2-1 W-2-1 W-2-1
3/28- 4/7	14	37/W002 39/W101	Material Test (Tentative) Fuel Material (F.P.)	100 hr (ea.) 1 hr	W-2-1* W-2-1
4/18-4/28	15	39/W103 39/W101 23/W107 23/W304	Fuel Material Fuel Material (F.P.) Resistance Thermometers } Thermocouples	4 hr (ea.) 1 hr 50 hr	W-2-1* W-2-1 W-2-1

*2 Capsules

<u>Date</u>	<u>Cycle No.</u>	<u>WANL Test No.</u>	<u>Test Item</u>	<u>Irradiation Times</u>	<u>Capsule Conditions</u>
5/9- 5/19	16	39/W103	Fuel Material	4 hr (ea.)	W-2-1*
		39/W101	Fuel Material (F.P.)	1 hr	W-2-1
		23/W008	Accelerometers	50 hr	W-2-1
		26/W004	Harnesses, Cables and Connectors	50 hr	W-2-1
		23/W508	Pressure Transducers	50 hr	W-2-1
5/30-6/9	17	39/W103	Fuel Material	4 hr (ea.)	W-2-1*
		39/W101	Fuel Material (F.P.)	1 hr	W-2-1
		23/W409	Strain Gauges	50 hr	W-2-1
		23/W108	Resistance Thermometers	50 hr	W-2-1
		23/W305	Thermocouples		
		23/W306	Thermocouples(W-W/Re)	50 hr	W-2-1
6/20-6/30	18	39/W103	Fuel Material	4 hr (ea.)	W-2-1*
		39/W101	Fuel Material (F.P.)	1 hr	W-2-1
		14/W007	Actuator Components	4 hr	W-2-1
		23/W207	Linear Displacement Transducers	50 hr	W-2-1
7/11-7/21	19	37/W003	Material Test (Tentative)	100 hr (ea.)	W-2-1*
		39/W103	Fuel Material	4 hr (ea.)	W-2-1*
		39/W101	Fuel Material (F.P.)	1 hr	W-2-1
8/1-8/11	20	39/W103	Fuel Material	4 hr (ea.)	W-2-1*
		39/W101	Fuel Material (F.P.)	1 hr	W-2-1
8/22-9/1	21	39/W101	Fuel Material (F.P.)	1 hr	W-2-1
		15/W202	Fuel Module Assembly		W-2-1
9/12-9/22	22	39/W101	Fuel Material (F.P.)	1 hr	W-2-1

*2 Capsules

III. SUMMARY OF WANL SUPPLIED FACILITIES AT PBRF

A W-2 water loop is presently being used in HT-1 at PBRF. In January, it is planned that a W-2-1 water loop be installed. This loop will provide the capability of inserting and removing test specimens during reactor operation. It is also planned that a cryogenic system be installed in August. This system will provide the flexibility of the W-2-1 loop and will provide the capability of testing at cryogenic temperatures. A brief description of each of these systems follows.

A. W-2 Water Loop

The W-2 loop is shown in Figure 2 (Drawing No. 566F394) and utilizes the reactor primary water as the coolant for experiments located in HT-1 of PBRF. The experiment is inserted into the HT-1 inside an 8-1/2" O.D. end entry re-entrant 6061Al capsule. Flow to the experiment is provided through a 2-inch "Unitrace" pipe which also acts as the experiment holder and actuating gas supply line. Electrical and instrumentation leads are normally brought out along the outside of the "Unitrace", however, the "trace" section can be used as a conduit for these leads. Experiments can be actuated by using bellows and a gas system supplied through the trace section of the "Unitrace".

The following instrumentation is provided on the W-2 loop and forms an integral part of the system:

2 Pen Recorders
L & N, M-Line

Pen No. 1 - System Flow 0-100 gpm

Pen No. 2 - System Flow 0-100 gpm

2 Pen Recorders
L & N, M-Line

Pen No. 1 - System Temperature 0-300°F

Pen No. 2 - System Pressure 0-300 psi

24 - Point Recorder
Daystrom Model 6704

Points 1 through 8 - System Temperature
60-260°F

Points 9 through 24 - Specimen Temperature
60-260°F

The following list shows the maximum parameters that are applicable to experiments to be installed in the system. It should be noted that an amendment to the AEC is presently being proposed to increase the length, weight and actuating gas pressure limits.

Max. Length	- 6.5 in.
Max. Diameter	- 6.12 in.
Max. Weight	- 9 lbs.
Max. Actuating Gas Pressure	- 290 psi
Water Flow (Normal)	- 75 gpm
Water Flow (Max.)	- 100 gpm
Max. Surface Temp.	- 300°F
Water Pressure	- 130 psi

B. W-2-1 Water Loop

The W-2-1 Water Loop utilizes an 8" O.D. capsule inside of the HT-1 of PBRF as the experiment container. Cooling of the experiment is by a self-contained demineralized water system as shown in Figure 3 (Drawing No. 387D53'9) which includes heat exchangers and purification equipment. To allow easy access to the capsule which is located approximately 23 feet below the quadrant water level, a gently-curving 8" diameter pipe connects the capsule

Figure 3. Flow Diagram for PBRF Trail Cable Facility (W-2-1)

entrance to the quadrant surface. An experiment is mounted on the end of a 1-1/2" diameter flex hose, and using the 8" pipe as a guide, is inserted or withdrawn from the HT-1. The coolant flow path is through the flex hose to the experiment and returns via the annulus between the hose and the 8" pipe.

Experiments can be gas or electrically-actuated by strapping small flexible hose or cables to the outside of the coolant supply hose. Instrument leads can be brought out in the same manner or remain loose inside the flexible hose.

The principal advantage of this system is the ease of insertion and withdrawal of experiments, allowing many short-term irradiations to be accomplished during the reactor operating cycle. In addition, fueled experiments can be conducted with less difficulty in a self-contained system.

The following instruments will be provided in the W-2-1 loop and form an integral part of the system:

W-2-1 Permanent Equipment

1 Pen Recorder L & N, M-Line	System Flow 0-100 gpm
24-Point Recorder Daystrom Model 6704	Various Temperatures 60-260°F
Flow Indicator (Rotometer) Brooks BR 3/4-14G5	Purification Flow 0-3 gpm

The operating parameters of the W-2-1 loop cycle are:

Flow	-	75 gpm
Pressure	-	Atmospheric
Experiment Diameter	-	5.5"
Experiment Length	-	6.5" (approximately)

C. W-1 Cryogenic Loop

The W-1 loop, shown in Figure 4 (Drawing 561245), provides a helium atmosphere at 100 psi and 50°R to experiments located within a 7" I.D. capsule in HT-1 of PBRF. The capability of instrumenting the experiment and inserting and withdrawing the capsule during reactor operation is provided.

Exchange of experiments is done in a hot cave which allows all work to be done without the experiment coming in contact with the quadrant water.

Purification of the helium is provided by a full-flow gel trap. A thaw system allows re-activation of the gel trap or thawing of various sections of the loop. To maintain the temperature at 50°R, the following maximum parameters will apply to experiments located in the W-1 loop. It should be noted that a change in environmental requirements will change the experiment size limitation.

Experiment Weight	-	3 lbs.
Experiment Length	-	9 in.
Experiment Diameter	-	6 in.
Helium Flow	-	0.47 lbs./sec.
Helium Pressure	-	100 psi

The following recording instrumentation is provided on the W-1 loop and forms an integral part of the system:

1	-	ΔP Recorder (across capsule)
1	-	24-Point Temperature Recorder
1	-	Temperature Recorder and Controller
1	-	Flow Recorder

Figure 4. Location of W-1 Cryogenic Test Loop Components and Panels in PBRF

IV. SUMMARY OF AVAILABLE DATA ACQUISITION EQUIPMENT

The following portable instrumentation is, or will be, supplied for use at PBRF by Westinghouse:

Strain Indicator	Budd Model HW-1
Millivoltmeter	Thermoelectric, No. 80236
DC Milliammeter	Simpson Model 373
Electrometer	General Radio Type 1230A
Vacuum Tube Voltmeter	Hewlett Packard Model 410C
Wheatstone Bridge	Rubicon Model 1071
Potentiometer	L & N, K-3
DC Millivoltmeter	Rubicon Model 2720
Tube Tester	Hickok Model 752A
Rotometer Kit	Brooks Model 1237

Any additional equipment necessary for the WANL tests will be supplied as needed by WANL.

V. SUMMARY OF PBRF SUPPLIED FACILITIES

1. HT-I Radiation Facility
2. Health Physics Services
3. Hot Cell (The WANL Test Program is based on the availability of one hot cell after Cycle 8.)
4. Provision of PBRF project engineering services
5. Plant Services (Electricity, water, etc.)
6. Office space and furniture