

PULSTAR ANNUAL REPORT TO
UNITED STATES NUCLEAR REGULATORY COMMISSION

for the

Period of 1 July 1984 - 30 June 1985

Submitted by

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NCSU NUCLEAR REACTOR PROGRAM

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PULSTAR Reactor Operations Manager

Reference: PULSTAR Technical Specifications
Section 6.7.5

Docket No. 50-297

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DEPARTMENT OF NUCLEAR ENGINEERING

PULSTAR REACTOR ANNUAL REPORT

For the Period: 1 July 1984 - 30 June 1985

The following report is submitted in accordance with Section 6.7.5 of the PULSTAR Technical Specifications:

6.7.5.a: Reactor Operating Experience:

(1) The NCSU PULSTAR reactor has been utilized for the following:

a. Teaching and Short Courses	146.92 hours
b. Graduate Research	398.15 hours
c. Faculty Research	14.42 hours
d. Isotope Production	100.53 hours
e. Neutron Activation Analysis	1,779.57 hours
f. NPP Reactor Operator Training	525.23 hours
g. PULSTAR Reactor Operator Training	74.59 hours
h. Reactor Calibrations and Measurements	26.51 hours
i. Reactor Health Physics Surveillance	1.19 hours
j. Neutron Radiography	13.82 hours

TOTAL 3,080.93 hours

Same reporting period 1983-84 2,708.98 hours

Reactor Facility Tours 63.00

A cross section of experiments performed in the reactor relate to these areas:

- a. Neutron Activation Analysis of animal tissue, fly ash, sediments, rain/river water, filters, resins, coal, milk, graphite, textile fiber, etc.
- b. Medical research isotope production; K-42, Na-24, P-32, etc.
- c. Reactor thermal power measurements for teaching laboratories.
- d. Fast neutron flux-induced damage to reactor pressure vessel steel specimens.
- e. Thermal neutron depth profiling of Boron-implanted silicon.
- f. Neutron diffusion length measurements in graphite.
- g. Target/detector distance and collimation optimization in the Prompt Gamma facility utilizing Boron, Cadmium, Molybdenum, Sulfur and Titanium.

(2) Changes in Performance Characteristics and Operator Procedures
Related to Reactor Safety:

None

(3) Results of Surveillance Tests and Inspections:

The reactor surveillance program has revealed no significant nor unexpected trends in reactor systems performance during this report period.

6.7.5.b: Total Energy Output:

1273.055 Megawatt-hours
53.044 Megawatt-days

: Pulse Operations:

0

: Reactor was critical:

1522.881 hours

: Cumulative Total Energy Output since Initial Criticality:

9985.532 Megawatt-hours
416.064 Megawatt-days

6.7.5.c: Number of Emergency and Unscheduled Shutdowns:

0

: Number of Inadvertent Scrams:

11

Reasons: (1) Operator Error 11

Explanation of (1) above:

Nuclear Power Plant Reactor Operator Training and NRP Staff Reactor Operator Training.

6.7.5.d: Major Maintenance Operations:

None during this reporting period.

6.7.5.e: Changes in Facility, Procedures, Tests and Experiments:

Design Changes: An improved design for the pulse power and energy measuring channel of the PULSTAR was approved by

the NCSU Radiation Protection Council in February of 1985. Installation, calibration and testing prior to routine use will be accomplished as time permits.

Procedures: Revision No. 4 to the PULSTAR Operations Manual was accomplished. This revision incorporated Advance Changes into the Manual text and also included some minor editorial alterations.

Experiments: Prompt Gamma Facility design finalized and installed in Beam Tube No. 5.

6.7.5.f: Radioactive Effluents

Liquid Wastes (summarized by quarters).

1. Radioactivity Released During the Reporting Period.

<u>Quarter</u>	<u>Period</u> <u>1984</u>	(a) <u>No. of</u> <u>Batches</u>	(b) <u>Total</u> <u>μCi</u>	(c) <u>Total Vol.</u> <u>Liters</u>	(d) <u>Diluent</u> <u>Liters</u>	(e) <u>Tritium</u> <u>μCi</u>
1st	1 July-30 Sept.	9	8.53	2.72 E4	2.13 E4	106.7
2nd	1 Oct.-31 Dec.	2	10.16	0.68 E4	2.54 E4	38.00
	1985					
3rd	1 Jan.-31 Mar.	4	0.56	1.35 E4	1.39 E3	87.00
4th	1 Apr.-30 June	6	6.17	1.96 E4	1.54 E4	111.3

(f) 25.42 μCi were released during this reporting period.

(g) 343 μCi of Tritium were released during this reporting period.

2. Identification of Fission and Activation Products.

The gross alpha-beta-gamma activity of the batches in 1(a) above were less than 4 E-5 μCi/ml. An isotopic analysis of these batches indicated only background activity.

3. Disposition of Liquid Effluents Not Releasable to Sanitary Sewer System.

All batches of 1(a) above when diluted by campus water released to the sewer resulted in activity considerably less than 4 E-7 μCi/ml. Therefore, all batches were released to the sanitary sewer system.

Gaseous Waste (summarized on a monthly basis)

1. Radioactivity Discharged During the Reporting Period (in curies) for:

(a) Gases

	<u>Period</u>	<u>Total Time Hours</u>	<u>Ci</u>
1984	11 July-9 Aug.	720.00	.66
	10 Aug.-6 Sept.	672.00	.53
	7 Sept.-4 Oct.	674.75	.71
	5 Oct.-1 Nov.	688.75	.76
	2 Nov.-28 Nov.	679.83	.71
	29 Nov.-27 Dec.	658.17	.74
1985	28 Dec.-29 Jan.	772.33	.81
	30 Jan.-26 Feb.	672.00	.79
	27 Feb.-27 Mar.	695.50	.47
	28 Mar.-26 Apr.	720.50	.84
	27 Apr.-27 May	711.75	.79
	28 May-26 June	720.17	.81
	Totals	8395.75	8.62

(b) Particulates whose half-life is greater than eight (8) days.

Filters from the particulate monitoring channel were analyzed upon removal each week. There was no particulate activity ((b) above) indicated on any filter during this reporting period.

2. Gases and Particulates Discharged During This Reporting Period.

Gases:

The yearly averaged concentration of Argon-41 released from the PULSTAR Reactor facility exhaust stack during this period was $3.02 \text{ E-8 } \mu\text{Ci/ml}$.

The MPC in an unrestricted area for Argon-41 is $4 \text{ E-8 } \mu\text{Ci/ml}$.

Particulates:

See Gaseous Waste 1(b) above.

Solid Waste from Reactor

1. Total volume of solid waste - 56.5 ft³
2. Total activity of solid waste - .34 mCi
3. Dates of shipments and disposal:

2 August 1984	Disposal by U. S. Ecology
23 August 1984	Disposal by U. S. Ecology
21 November 1984	Disposal by U. S. Ecology
10 December 1984	Disposal by U. S. Ecology
16 January 1985	Disposal by U. S. Ecology
20 March 1985	Disposal by U. S. Ecology
7 May 1985	Disposal by U. S. Ecology
19 June 1985	Disposal by U. S. Ecology

6.7.5.g: Personnel Radiation Exposure Report (Reporting Period 07/01/84-06/30/85)

Faculty and Staff

<u>Name</u>	<u>Total Exposure (rem)</u>
Auciello, Orlando E.	0.0
Biddy, Oscar D.	0.0
Bilyj, Stephen J.	0.050
Brackin, Thomas L.	0.030
Bray, Thomas C.	0.0
Caves, John R.	0.020
Cornetti, Richard	0.010
Davis, Glenda	0.0
Doster, J. Michael	0.0
Gardner, Robin P.	0.0
Gilligan, John	0.0
Grady, Stanley M.	0.010
Hankins, Orlando H.	0.0
Kimberley, Michael M.	0.040
Kohl, Jerome	0.0
Lambert, J. P.	0.0
Mani, K. V.	0.0
Miller, Garry D.	0.060
Munn, Hugh	0.020
Murty, K. L.	1.460
Rayno, Donald	0.060
Saxe, Raymond F.	0.250
Stam, Ephraim	0.0
Strickland, David D.	0.0
Turinsky, Paul	0.0
Verghese, K.	0.0
Weaver, Jack N.	0.060
Wehring, Bernard	0.0
Wilshire, Frank	0.0

Radiation Protection Office Personnel

Anderson, Tommy L.	0.0
Beasey, Douglas B.	0.0
Bowman, Worth B.	0.040
Corbett, Marcelle	0.040
Emery, Robert	0.0
Harris, Ralton	0.0
House, Andy	0.0
Mangum, Royelle	0.240
Morgan, D.W.	0.030
Smith, Thomas	0.0

Custodians

Dunn, Johnnie J.	0.0
Lucas, Calvin	0.0
Saunders, Dorothy	0.0
Young, Charles	0.0

Other - 47 film badges were issued to graduate students and temporary staff, 95 badges were issued for student laboratories, 115 film badges were issued to participants in short courses, 377 film badges were issued to visitors. No significant radiation exposures were reported; the majority of the radiation exposures were in the "no measurable exposure" range.

6.7.5.h: Summary of Radiation and Contamination Surveys Within the Facility

Neither the radiation nor the contamination surveys indicated any trend or shift of data from past experience/surveys.

6.7.5.i: Description of Environmental Surveys Outside of the Facility.

(See Attachment A)