PULSTAR ANNUAL REPORT TO

UNITED STATES NUCLEAR REGULATORY COMMISSION

for the

Period of 1 July 1981 - 30 June 1982

Submitted by

R. G. Cockrell, Director

NCSU NUCLEAR REACTOR PROGRAM

Prepared by Thomas C. Bray
PULSTAR Reactor Operations Manager

Reference: PULSTAR Technical Specifications

Section 6.7.5

Docket No. 50-297

Department of Nuclear Engineering
North Carolina State University
Raleigh, North Carolina 27650

August 27, 1982

DEPARTMENT OF NUCLEAR ENGINEERING

PULSTAR REACTOR ANNUAL REPORT

For the Period: 1 July 1980 - 30 June 1981

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	105.98 hours
b.	Graduate Research	10.26 hours
c.	Faculty Research	19.21 hours
d.	Isotope Production	40.45 hours
e.	Neutron Activation Analysis	1762.37 hours
f.	Neutron Radiography	11.32 hours
g.	NPP Reactor Operator Training	1230.37 hours
h.	PULSTAR Reactor Operator Training	55.61 hours
i.	Reactor Calibrations and Measurements	29.43 hours
j.	Reactor Health Physics Surveillance	7.80 hours
k.	Tours and Visitors*	2.42 hours
	TOTAL	3275.22 hours
	Same reporting period 1980-81	2640.56 hours
	* Reactor Facility tours not utilizing the reactor.	92.00 hours

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

a. Axial neutron flux mapping in graphite thermal column.

b. Ball Milling and related flow tracer studies.

c. F-18, K-42 and Na-24 production for medical research.

d. Reactor Noise Measurements using a water-driven cadmium ribbon as fuel vibration simulator.

e. Neutron Activation Analysis of fly ash, animal tissue, sediments, rain/river water, resins, coal, graphite, milk, textile fibers, etc.

f. Neutron Radiography of electrical connectors, capacitors, B_4C absorber rods, hydrogenous sealants, RTD construction materials.

(2) Design Changes Accomplished:

No. 81-1 Replace existing reactor coolant temperature measuring system with improved equipment.

(3) Changes in Performance Characteristics and Operator Procedures related to Reactor Safety:

None

(4) Results of Surveillance Tests and Inspections:

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

6.7.5.(b): Total Energy Output:

1022.21 Megawatt-hours
42.15 Megawatt-hours

: Pulse Operations:

0

: Reactor was critical:

1438.18 hours

: Cumulative Total Energy Output since Initial Criticality

5704.81 Megawatt-hours
279.37 Megawatt-hours

6.7.5.(c): Number of Emergency and Unscheduled Shutdowns

0

: Number of Inadvertent Scrams:

55

Reasons: (1)	Operator error	51
(2)	Low Primary Flow setpoint drift	1
(3)	Loss of commercial power	3

Explanation of (1) above:

Nuclear Power Plant Reactor Operator Training (48) and NRP staff operators (3).

Explanation of (2) above:

Primary coolant flow rate trip switch activated at a conservative 490 gpm rather than the 475 gpm designated setpoint. Small indicated fluctuations of brief duration are normal in the primary cooling system.

Explanation of (3) above:

Commercial or campus electrical power interruptions result normally in reactor shutdown. Procedural response to this occurrence requires starting the auxiliary generator and monitoring the reactor power decrease until the control rod magnets are fully down.

6.7.5.(d): Major Maintenance Operations:

None during this reporting period.

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

Design Change 81-1 "PULSTAR Reactor Cooling System Temperature Measurement Channel Replacement with Improved, Similar Equipment" was accomplished to improve system accuracy.

The original temperature measuring channel incorporated sensors (RTD's) with fixed thermal-electrical characteristics, not capable of individual sensor calibration. Heretofore, when a sensor aged out of specified accuracy, replacement was necessary and expensive. The replacement temperature measuring system features RTD's with individual current transmitters that enable each RTD output to be calibrated independently. Total system accuracy is improved and RTD replacement due to normal use aging has been eliminated.

Safety Evaulation: " The primary and secondary cooling system temperature measuring channel is part of the Reactor Safety System (RSS); therefore, this change is a safety-related issue. System accuracy of the replacement equipment is superior to that currently installed and was selected because of excellent performance history in many NPP facilities."

6.7.5(f): Radioactive Effluents

Liquid Wastes (summarized by quarter)

1. Radioactivity Released During the Reporting Period

Quarter	Period 1981	No. of Batches	Total μCi	Total Vol. Liters	Diluent Liters	Tritium Ci
1st	1 July-30 Sept.	8	18.72	2.56E4	3.14E4	141.74
2nd	1 Oct.-31 Dec.	10	41.15	3.19E4	8.10E4	887.46
	1982					
3rd	1 Jan.-31 Mar.	6	24.41	1.97E4	4.22E4	200.46
4th	1 Apr.-30 June	8	7.97	2.62E4	3.56E4	201.59

(f) 92.25 μCi of activity were released during the reporting period.

(g) 1.43 μCi of tritium were released during the reporting period.

2. Identification of Fission and Activation Products.

The concentration of each batch of 1.a above was less than 4E-5 μCi/ml. Therefore, an analysis was not required. However, several batches were analyzed with only background data indicated in the sample spectrum.

3. Disposition of Liquid Effluents not Releasable to the Sanitary Sewer System.

The concentration of activity in each batch of 1.a above, considering the campus dilution water as necessary, was equal to or less then 4E-7μCi/ml (10CFR20, Appendix B, Note 2d) and, therefore, each batch was released to the sanitary sewer system.

g. Gaseous Waste (summarized on a monthly basis)

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

(a) Gases

	Period	Total Time Hours	Ci
1981	17 Jun.-16 Jul.	709.37	.56
	16 Jul.-14 Aug.	689.37	.71
	14 Aug.-21 Sept.	905.12	.85
	21 Sept.-20 Oct.	699.52	.45
	20 Oct.- 19 Nov.	723.70	1.02
	19 Nov.-18 Dec.	703.37	.99

	18 Dec.-18 Jan.	735.75	.12
1982	18 Jan.-16 Feb.	701.50	.94
	16 Feb.-17 Mar.	697.83	.87
	17 Mar.-16 Apr.	712.42	1.10
	16 Apr.-14 May	700.45	1.16
	14 May-14 June	735.80	1.19
		8714.20	9.96

(b) Particulates with half lives greater then eight (8) days.

Particulates whose half life is greater than eight (8) days were not found on any filter removed from the Particulate Monitor during the reporting period.

2. Gases and Particulates Discharged During this Reporting Period.

Gases:

Argon-41 was discharged to the atmosphere through our exhaust stack. The total activity was 9.96 curies for an average (yearly) concentration of 6.73 E-8 μCi/ml. Our exhaust stack is 100 feet high.

The MPC for A-41 is 4E-8 μCi/ml in an unrestricted area.

Particulates:

See 1.b above.

Solid Wastes from Reactor

1. Total volume of solid waste - 309.1 ft^3

2. Total activity of solid waste - 0.73657 curies

3. Dates of shipments and disposition:

4 August 1981	Disposal by US Ecology
14 August 1981	Disposal by US Ecology
16 September 1981	Disposal by US Ecology
15 December 1981	Disposal by US Ecology
27 January 1982	Disposal by US Ecology
8 March 1982	Disposal by US Ecology
17 May 1982	Disposal by US Ecology
20 July 1982	Disposal by US Ecology

6.7.5(g) Personnel Radiation Exposure Report (Reporting Period - 1 June 1981 - 31 May 1982)

Name	Total Exposure (rem)
Faculty and Staff	
Biddy, Jr., Oscar D.	0.0
Bilyj, Stephen J.	0.090
Brackin, Thomas L.	0.040
Bray, Thomas C.	0.070
Caccamo, David P.	0.020
Cockrell, Robert G.	0.020
Cross, Robert D.	0.0
Douglas, William G.	0.020
Gardner, Robin P.	0.020
Grady, Stanley M.	0.050
Kohl, Jerome	0.040
Lawrence, Craig	0.030
Lewis, Luther E.	0.020
Munn, Hugh	0.0
Davis, Glenda	0.030
Saxe, Raymond F.	0.090
Stam, Ephraim	0.0
Turinsky, Paul	0.010
Verghese, K	0.0
Weaver, Jack	0.0
Radiation Protection Office Personnel	
Anderson, Tommy L.	0.0
Caruthers, L. Thomas	0.020
Corbett, Marcelle	0.0
Debnam, Joshua	0.0
Freeman, Ralph M. (Terminated 02/28/82)	0.0
Harris, Ralton	0.0
House, Andrew	0.0
Mangum, Royelle O.	0.0
Morgan, D. William	0.0
Custodians	
Dunn, Johnnie J.	0.0
Lucas, Calvin	0.0
Saunders, Dorothy	0.0
Young, Charles	0.0

Other

46 film badges were issued to graduate students and temporary staff, 49 film badges were issued for student laboratories, 203 film badges were issued to participants in short courses, and 632 film badges were issued to visitors. No significant radiation exposures were reported. The majority of the radiation exposures were in the "no measureable exposure" range.

Summary of Radiation and Contamination Surveys

Radiation surveys of the PULSTAR Bay did not indicate any trend of increasing radiation levels. The Neutron Radiography Unit was disassembled and the beam tube reconfigured in the normal manner. This change reduced the radiation levels in this area.

Contamination surveys during the reporting period were negative. Prompt and car[illegible] clean-up after accomplishing schedule tasks precludes routine surveys from finding contamination.

h. Description of Environmental Surveys Outside of the Facility.

(See Attachment 1)

Attachment 1

North Carolina State University
P.O. Box 5344, Raleigh, NC 27650-5344

Telephone (919) 737-2894

214 David Clark Labs

30 August 1982

Mr. Thomas C. Bray
Reactor Operations Manager
2126 Burlington
NC State Campus

We have experienced several major equipment failures in our environmental surveillance laboratory over the last several months. This has caused a delay in our preparation of the Environmental Surveillance Report for this period.

I understand that you plan to submit the PULSTAR Annual Report to the Nuclear Regulatory Commission by 30 August 1982. Please note in the report that the environmental radiation surveillance data will follow later in the next 10 - 14 days.

Thank you for your assistance and indulgence in this regard.

D. W. Morgan, Associate
Radiation Protection Officer